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ELECTRICAL WORLD

DECEMBER 10, 1932
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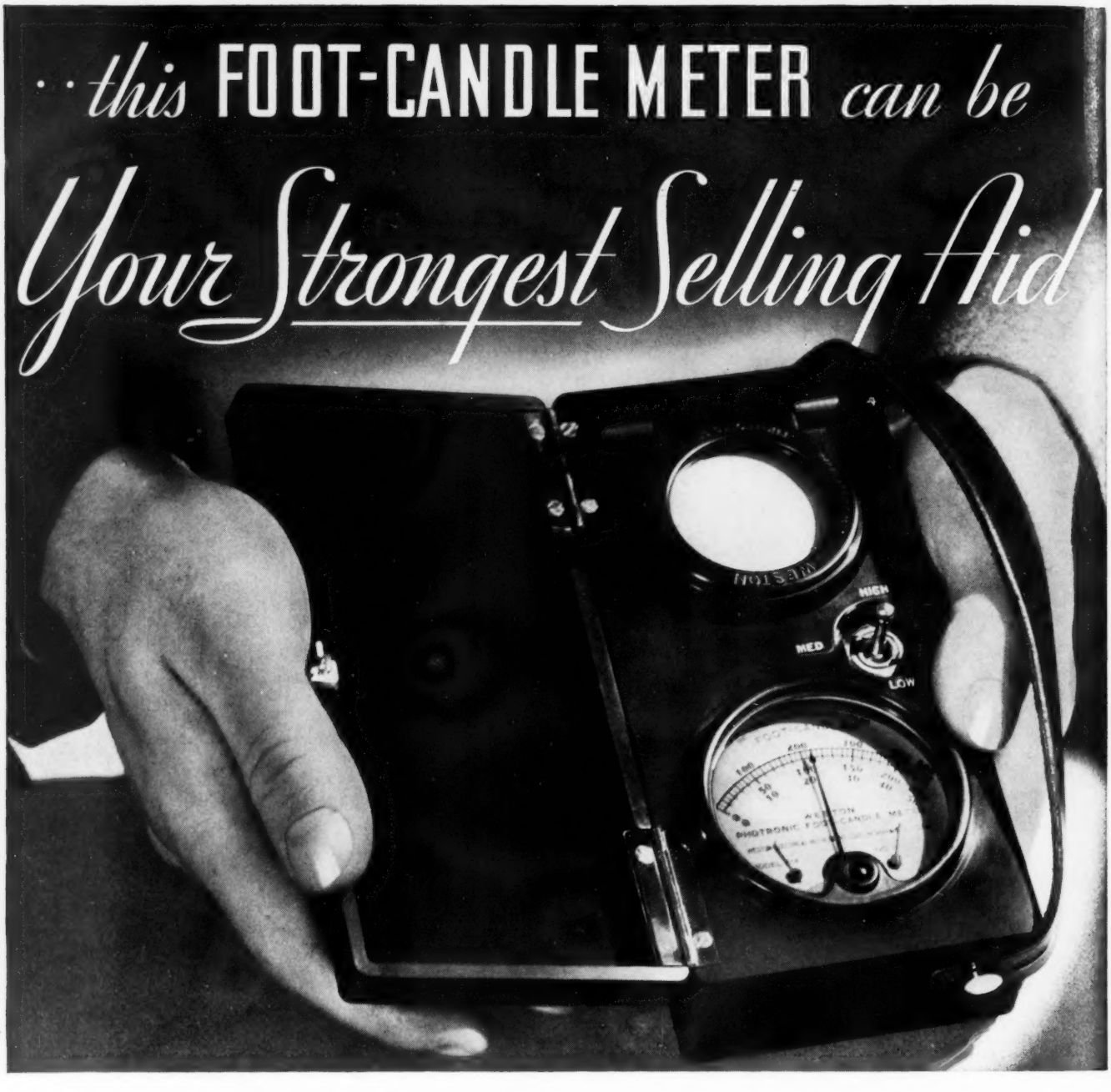

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ELECTRICAL WORLD

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for the Week Ending

December 10, 1932

J. B. Whitehead Nominated for Next A.I.E.E. President

John B. Whitehead, dean of the school of engineering, Johns Hopkins University, Baltimore, has received the nomination for the presidency of the American Institute of Electrical Engineers, to take office in August, 1933. The choice of the nominating committee will undoubtedly be indorsed by the members of the Institute when they vote by mail in the spring.

Nominees for vice-presidencies include: Prof. A. M. Wilson, University of Cincinnati, district 2; F. M. Craft, Southern Bell Telephone & Telegraph Company, Atlanta, district 4; R. B. Bonney, Mountain States Telephone & Telegraph Company, district 6; Prof. R. W. Sorensen, California Institute of Technology, Pasadena, district 8, and A. H. Hull, Hydro-Electric Power Commission, Toronto, district 10. Directors named for a four-year term include Paul B. Juhnke, Commonwealth Edison Company, Chicago; Everett S. Lee, General Electric Company, Schenectady, and L. W. W. Morrow, ELECTRICAL WORLD, New York. Professor W. I. Slichter, Columbia University, was renominated national treasurer.

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Insull Company Committees in East Clash on Plans

Plans to effect a reorganization of Eastern public utility properties formerly controlled by the Insull interests have been endangered during the past week by differences of opinion among the elements that have been working on the reconstruction program. For nearly five months committees representing debenture holders of the National Electric Power Company and the National Public Service Corporation, both in bankruptcy since last summer, have collaborated in formulating a plan and in revising it to meet the opposition of the various creditors, with whom most of the underlying assets were pledged under the Insull régime. The National Public Service Committee has expressed dissatisfaction and withdrawn from the proceedings. Because of the complexity of the structure and the numerous bank loans the co-operation of the debenture holders' committee of the two main companies is viewed as essential.

Efforts to recover $20,000,000 in securities held by New York bankers and to discover other assets of the bankrupt Insull Chicago investment organization will be made promptly in New York by Lewis F. Jacobsen and Harold F. White, attorneys for the creditors. The search for Insull assets in the East has been ordered by Federal Judge Walter C. Lindley.

In the meantime the status of Samuel Insull remains uncertain. The United States Legation in Athens has advised the Greek Foreign Office that warrants and final extradition papers are now in its possession. It is probable that they will soon be sent to the Minister of Justice for action by the Court of Appeals. Another remand has been granted to Martin J. Insull, whose extradition to the United States is being sought, until February 7, this being the third adjournment of the proceedings.

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Sales management, in the majority of industrial concerns, is markedly inferior to the management of production, and yet the dire need, in this period of unbridled competition, for the most effective and profitable sales is evident. Executives throughout the land are devoting their efforts chiefly to marketing problems. It would appear that there is an opportunity as yet unappreciated by many of them for profitable sales through more scientific methods of sales management.

SANFORD E. THOMPSON,
President Taylor Society.

[Mr. Thompson, at the annual dinner of the society this week, reported upon the results of a survey made of 50 national industries which showed "the vast preponderance of firms compensating solely on the basis of volume sold, without regard to any other factors." Mr. Thompson characterized this as "akin to the antiquated and obsolete payment in factories of uniform piece rates, regardless of variations in the character of operations."]

Radical Meter Ruling Proposed in New York

If proposed changes in the electric meter rulings of the New York Public Service Commission are adopted they will constitute a considerable departure from other commission rulings. In the rulings just set up for hearing on December 14 the commission would not allow the customary plus and minus tolerance in meter accuracy, but only that a meter must on test be adjusted correct or slow, but never left fast.

This proposed ruling is proposed in the face of country-wide and even federal rules to the contrary. The New York State law now allows 2 per cent tolerance in electric meters, but there is some doubt over whether this applies to all meters or only those on which complaints have been received. The New York and United States Departments of Weights and Measures allow plus and minus tolerances on all linear, dry and wet, and weight-measuring devices.

If the revised ruling is adopted the utilities may be forced to adjust all meters to run at least 1 per cent slow so they will not run fast at any time, with a consequent loss of gross revenue.

On the other hand, the rules will permit a six-year interval for periodic test of meters under 6 kva. rating. In computing average accuracy the full load test will be given four times the weight of the light load test.

Associated Gas Receivership Denied by Court

Application of Phillip Newbold, stockholder, for a receiver of Associated Gas & Electric Company (ELECTRICAL WORLD, November 26, page 709, and December 3, page 739) has been denied by Justice Wasservogel of the New York Supreme Court. The opinion of the court stated that the plaintiff, holder of 104 out of more than 4,500,000 shares of outstanding class A stock, "bases his right to this relief solely on the complaint. The individual defendants, who are officers and directors of the company, are charged with fraud and mismanagement. Neither fraud nor mismanagement has been established.

"It is not claimed that the company is insolvent, nor has it been shown that the property of the company is in danger of being lost, materially injured, destroyed or removed from the jurisdiction. Under no circumstances, on the papers now before the court, is there warrant for granting to plaintiff the drastic relief which he seeks. Motion denied."

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Steam Unit Performance Sustained, Report to A.S.M.E. Shows

ENCOURAGING maintenance of the reliability, economy and efficiency of steam boilers and auxiliaries was evidenced in the report presented to the American Society of Mechanical Engineers at its annual meeting in New York this week by C. F. Hirshfeld, chief of the research department, Detroit Edison Company, and G. V. Moran of his organization. No appreciable difference in the reliability of pulverized fuel and stoker-fired units was shown. Further improvement is amply foretold. The report covered 250 large units and added three years of experience data to a previous (1929) report.

Emphasis in this investigation was placed on causes of outages, effects of use, design, fuels and methods of firing. Boilers showed a present availability factor of 82-86 per cent. In analyzing design factors as many as twenty-variations with their concomitant results have been discussed. All the boilers operated at about 60 per cent of maximum continuous steaming capacity for 70-85 per cent of steaming hours. Major causes of outages in the stoker class were recorded as difficulties with preheated air, wrong type of coal, plain refractory wall, slag accumulation and erosion, tube replacement and valves. In the pulverized fuel class these were replacing of mill hammers, liners and grinding balls.

Tube failure causes investigated

Proposals to use thinner tubes than called for in the A.S.M.E. Boiler Code in order to reduce the total stresses due to heat transfer and internal fluid pressure were controverted by W. L. DeBaufre of the University of Nebraska, at the central station power session. It was Mr. DeBaufre's contention that: Before a boiler tube can fail by bursting, all portions of the tube wall must be stressed to a point where more or less rapid creep will occur to rupture. Investigation shows that before this can take place all heat-transfer stresses will be entirely neutralized by creep. Failure of the tube then occurs by the stresses due to internal pressure only. Investigation shows, says Mr. DeBaufre, that an increase in tube safety is secured by using thicker rather than thinner tubes than called for by the A.S.M.E. Boiler Code. An increase in safety may also be obtained by using a material which will not creep until a higher stress is reached, such as a medium-carbon steel in place of a mild carbon steel.

Boiler-tube failures occur by reason of poor circulation of the water-steam mixture within the tubes, by accumulation of scale on the inner surface of the tube wall, by corrosion, or by defective material, rather than by any stresses due to unequal expansion within the tube wall caused by a high rate of heat absorption, said Mr. DeBaufre.

Delray stoker improvements

Progressive redesign of the record-size underfeed stokers at Delray power house No. 3 of the Detroit Edison Company was reported by Messrs. P. W. Thompson and F. J. Chatel of that company. Single-end stokers, rated to burn 34,000 lb. of coal per hour, were initially chosen to simplify boiler house arrangement and economize in building investment through concentration of bunker and conveyor equipment in a single firing aisle. The only real advantage derived has, however, proved to be the operating convenience of the single-end design. A 12 to 1 crankshaft speed range permits an acceleration in one hour from the evaporation rate of 50,000 lb. per hour of a floating bank to 430,000 lb. per hour of steam generation under loading conditions.

Some of the factors developed in the stoker equipment at Delray were:

(1) Change from a six- to a four-pusher arrangement made it possible to burn efficiently a wider range of fuels. (2) Clinker formation reduced by a change in the shape of the bottom pushers, installation of slag deflectors in the side walls, and better packing of the coal in the retorts. (3) Amount of iron burned reduced by elimination of high side-wall air backs, installation of side-wall slag deflectors, more certain coal supply and improvements to the extension grates. (4) Automatic air control. (5) Maintenance reduced by changes in mechanical design and full use of heat-treated material. (6) Continuous coal-burning rate of 56 lb. per sq.ft. per hour, for which the stoker was designed, is only limited by accumulation of ash on the slag screen and superheater tubes. (7) One stoker operated for a short period with preheated-air temperatures as high as 500 deg. F. without loss of combustion efficiency. (8) Infiltration of air reduced the expected heat absorption in the air preheaters, and consequently the over-all efficiency of the steam-generating unit.

Election of Dean Andrey A. Potter of the Schools of Engineering of Purdue University, as president for 1932-33, by mail ballot of the society's 20,000 members, was announced at the opening sessions, as were also the election of H. V. Coes, of Ford, Bacon & Davis; James D. Cunningham of Republic Flow Meters Company, and C. F. Hirshfeld of Detroit Edison as vice-presidents.

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Radio Directors Resign; Stockholders' Suit Entered

Resignation of officials of General Electric and Westinghouse from the board of directors of the Radio Corporation of America has followed the court decree in the dissolution suit (ELECTRICAL WORLD, November 26, page 705). Gerard Swope, Gordon Abbott, Albert G. Davis, Edwin W. Rice, Jr., of General Electric and Paul D. Cravath, Frank A. Merrick and Harold Smith of Westinghouse have retired. The vacancies have not been filled. At present Owen D. Young of General Electric and A. W. Robertson of Westinghouse remain on Radio's board as representatives of the two companies. The terms of the court decree allow them to remain on the Radio board for five months.

A stockholders' suit seeking the return to the Radio Corporation of 7,500,000 of its shares of the stock now held by the General Electric Company and Westinghouse Electric & Manufacturing Company was filed in the New York Supreme Court, Nov. 30, as an aftermath of the federal court order dissolving the alleged radio monopoly. The suit, brought by the Torquay Corporation, holder of 200 shares of

R.C.A. stock, also asked appointment of a receiver for the stock pending settlement of the litigation in the federal courts.

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Lamp Sales and Buyer Linked by Westinghouse Survey

To determine all the pertinent whys and wherefores of lamp buying psychology and light use and appeal the Westinghouse Lamp Company sponsored a survey made by the Houser Associates in seven communities and including 566 homes. These involved virtually every type and class of dwelling. Among the objectives was the determination of the attitude of the occupant toward artificial light, for decoration and health, buying habits and cost of lighting.

Better store light would make shopping more attractive, said 18 per cent of the housewives. More than half declared that homes of some neighbors could be made more attractive by improving the lighting.

In all classes of homes the living room ranked first in available wattage—175 for low-class homes, 280 for medium and 385 for high. Dining rooms were second.

No convenience outlets were found in 29 per cent of low-class living rooms, or in 7 per cent of medium or 4 per cent of high-class homes. In the dining room the figures were 63 per cent, 35 per cent and 23 per cent respectively. In the kitchen 55 per cent, 34 per cent and 32 per cent. How are appliances to be sold for use there if no place is available for connection?

That the living room was the best furnished and lighted room in the house was the contention of 74 per cent of the home makers. Bedrooms, by vote of the owners, are the poorest lighted.

What home makers want

Here is what the survey shows home makers to want in percentage of those responding:

More convenience outlets, 40 per cent; more portable lamps, 20 per cent; decorative living room wall brackets, 11 per cent; new center fixtures, 10 per cent (7 per cent want center fixture removed); extra lamps elsewhere, 7 per cent; wall brackets in kitchen or bath, 6 per cent; wall switch control, 5 per cent; larger lamps, 3 per cent; indirect lighting, 2 per cent, and different lamp shades, 1 per cent.

Based on the results of this survey, here but briefly résuméd, and considering national probabilities, Westinghouse Lamp Company sees the potential home-lighting market as:

Portable lamps, 40,190,000, $286,000,000; additional lamp bulbs, 71,282,000, $7,128,270; additional utility revenue (at 6 cents a kilowatt-hour), $8,553,000. Without including wiring supplies, convenience outlets, etc., a $300,000,000 market.

Needed: Courage to Face the Facts

What, whisper the timid souls, and who hasn't had a touch of cold feet these days, will ever become of us all, if———? Just suppose that America has to shoulder those foreign loans without payments from abroad———? Suppose things don't get better———? And if the farmers aren't given some relief, then ———? Suppose these Technocracy chaps are right and———?

All right, LET'S SUPPOSE. Let's suppose, going right back to the basic facts, that commodity prices, which are the key to the whole situation, stay right where they are today, go somewhat lower or resume any pre-war level that is open to supposition. Suppose that the mortgages on those farms, which were only plastered on under the expansive hopes of war and post-war days, are written down to something near a marginal value on a salable price. Suppose labor takes lower wages — goes back with commodities to pre-war days. Suppose all that great excess of producing capacity, with its implacable overhead charges, which burden industry today, is written down and capital takes the bumps. Suppose that we don't all ride in motor cars, have radios and that the standards of wealth of pre-war days come back. SUPPOSING ALL THAT. Is there anything to fear?

The trouble is that we are all still trying to keep up with the fabulous Joneses. Still trying to keep pace with our yesterdays and still hoping that things be not as they are. That presently we will be back in the beautiful dream with the nightmare over. We can be. But it won't be the same dream. The world has ever been forced to face its tomorrows. We can't raise commodity prices. Let's adjust ourselves to them.

Currently, things are dispiritedly drifting along. Carloadings up, carloadings down. Energy production never much better and never much worse. Commodities and stocks stronger on the basis of President Hoover's message to Congress. America needs courage to face facts which it appears are not so black and terrifying after all.

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Pennsylvania Investigation Deferred Temporarily

Court injunctions restraining the Rial Senate committee from further investigation of certain public utilities and the members and former members of the Pennsylvania Public Service Commission have halted the progress of the probe temporarily. Two executive sessions and one open session were held by the committee following the granting of the injunctions and it was decided to call off the hearings until Chairman Rial will have fixed another date.

The committee had intended to examine the banking and brokerage records, covering a period of ten years, of commissioners past and present, and to check over investment securities of subsidiary operating electric power companies of the Associated Gas & Electric Company in the State of Pennsylvania, but the granting of temporary injunctions by the courts of Dauphin and Fayette Counties prevented this procedure. The questions involved in the court proceedings are primarily the right of the committee to delve into the personal affairs of commissioners and the right of the committee to spend the $100,000 legislative appropriation provided at the last special session. If the court proceedings block further hearings at the present time, the inquiry can be resumed early in January under the authorization of the next General Assembly.

Despite the fact that further public hearings are out of the question temporarily, the committee made plans to go ahead with its work of framing new legislation amending the public service company act as it relates to securities, holding companies, rates, reparation and public counsel. A tentative draft of these proposed changes was presented to the committee by Dr. John G. Hervey, legal adviser to the committee.

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Ford Sued Over Shoals Plan Entered Upon in 1930

Suit against Henry Ford to compensate for alleged violation of a contract regarding Muscle Shoals has been entered in the District of Columbia Supreme Court by John H. Connaughton of Washington. The plaintiff asks participation in $2,000,000 profits alleged to have been made under a contract between Ford and three others to facilitate leasing or buying of Muscle Shoals. The contract is said to have been dated December 3, 1930, and Ford is alleged to have placed a fund of $88,000,000 as deposit in anticipation of the deal and to have caused the incorporation of the Alabama Development Company.

War Department officials have expressed surprise at the intimation that Ford was actively interested in securing leases or purchase of Muscle Shoals at that time. His interest was thought to have terminated some years ago with the failure to secure Congressional approval for his offer. Just where a profit of $2,000,000 might have arisen is also causing some speculative comment.

Coming Meetings

American Association for the Advancement of Science—Annual convention, Atlantic City, N. J., Dec. 27-31. C. F. Roos, Smithsonian Institute, Washington, D. C.

American Physical Society — Annual meeting, Atlantic City, Dec. 28-30. W. L. Severinghaus, Columbia University, New York.

American Institute of Electrical Engineers—Winter convention, New York, Jan. 23-27. H. H. Henline, 33 West 39th Street, New York.

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Maryland Board Prefers Indexes to Appraisals

"This commission is convinced that when once a fair value has been found for the property of a utility, as of a certain date, such value and subsequent net additions can be trended forward to show reproduction cost at any later date, with fully as great accuracy as can be accomplished by the more tedious and expensive method. We are also convinced that without the use of the trending method regulatory commissions in the future will find it impossible to keep pace with the demand for rate base adjustments, so long as reproduction cost continues to be given the weight now accorded it in determining value." Such was the pronouncement last week of the Maryland Public Service Commission in establishing an $11,616,072 rate base for the electric properties of the Potomac Edison Company, an American Water Works & Electric Company subsidiary.

Estimates of reproduction are construed by the commission to pertain exclusively to the reproduction of the physical plant and not to the reproduction of the corporation. Such allowance as is made for going concern value is made only in deference to the dictum of the Supreme Court on this point. But all other elements of organization and overhead which cannot be justified as components of going concern were excluded because they verge more on fictitious reproduction of the corporate enterprise than on "reproducing the utility."

Testimony of Frank W. Lawrence of Sanderson & Porter to prove a reproduction value of $29,170,000 was spurned as "extravagant," "absurd" and "ludicrous" because it laboriously set up all promotion, engineering survey, legal scrutiny, incorporation and financing costs on a purely hypothetical foundation. The commission also set up 12 per cent for electric property depreciation, an amount more than three times the $574,897 admitted by the company; of the difference, $285,333 was due to the company's failure to depreciate the overhead items along with physical plant values. An overhead allowance of 6 per cent of direct costs was made for undistributable labor and expense and 9 per cent for engineering supervision and contractor's profit. Two per cent was allowed for tax on land only and another 2 per cent to cover organization, franchise cost, legal expense, injuries and damages, and miscellaneous.

Interest during construction was fixed at $564,770 for the electric property. Working capital was figured at one-eighth annual operating expense plus average materials and supplies inventory. No allowance was made for commissions and contingencies because the pricing was not based on competitive values. For electric going value a figure of $700,000 was included, specifically excluding entirely "that portion of the going value which the customers have already paid out of rates." A model home and its site, merchandise inventory, half the stock of spare distribution transformers and half the value of a standby plant were excluded from the rate base.

In concluding its finding, the commission announced that the close agreement of original cost, trended by application of price indices, and the reproduction cost, depreciated, justified adopting the latter as the basis for fair value.

Reproduction value theory assailed

In commenting on the general theory of establishing a value for rate-making purposes the report stated: "The theory of establishing value to be used as a rate base by estimating what it would cost to reproduce property as of a given date, even when reasonably applied, is open to grave objections. It is regarded by many able and thoughtful men as unsound economically, legally and in the light of reason. But the Supreme Court has spoken, and no agency other than the Supreme Court itself can effectively do anything about it. This commission accepts the doctrine as laid down by the court in good faith and abides by it, even though it feels that it would have been better for the public and the utilities alike if the court had ruled at the outset that a utility, charged with the public interest from the beginning, is entitled to earn only a fair return on the money fairly and honestly invested in it; no more when commodity prices are high, and no less when commodity prices are low. . . ."

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Associated Shifts Properties

Just another step in the complicated affairs of Associated Gas & Electric was effected last week with the disposal of the investment of the Associated Gas & Electric Corporation in Eastern Utilities Investing Corporation and Binghamton Light, Heat & Power Company to the Associated Gas & Electric Company. The two companies transferred are not engaged in utility operations and no securities of the Binghamton company are in the hands of the public.

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New Hampshire Commission Condemns Holding Company

Need of additional legislation to control public utility holding companies was pointed out in the biennial report of the New Hampshire Public Service Commission sent last week to Governor Winant. "Holding companies," the report said, "are unregulated at the present time by either state or federal authority. . . . To justify their continuance in being, it has been claimed a holding company offered invaluable banking associations whereby large sums of money could be quickly secured; that technical staffs were maintained for advice and consultation; that the combined purchasing power of affiliates assured securing equipment at bargain prices; that skilled management was afforded through the association, and in fact they were a panacea for all the ailments of a utility from poor public relations to an outlet for security issues.

"Experience has taught that in times of stress a sound operating company may maintain infinitely superior banking associations; that holding company technical staffs are many times maintained at an expense to the utilities disproportionate to the benefits received; that the purchasing power lure is frequently mythical; that often the featured management is a hoax, and that in many cases the holding companies merely mask a horde of so-called servicing subsidiaries as devices to milk operating companies.

"The public faith has been most shocked where the funds or credit of the utilities are used or pledged to support the crumbling top companies. To curb these abuses additional legislation may be recommended at the proper time."

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Utility Management Fee Terminated

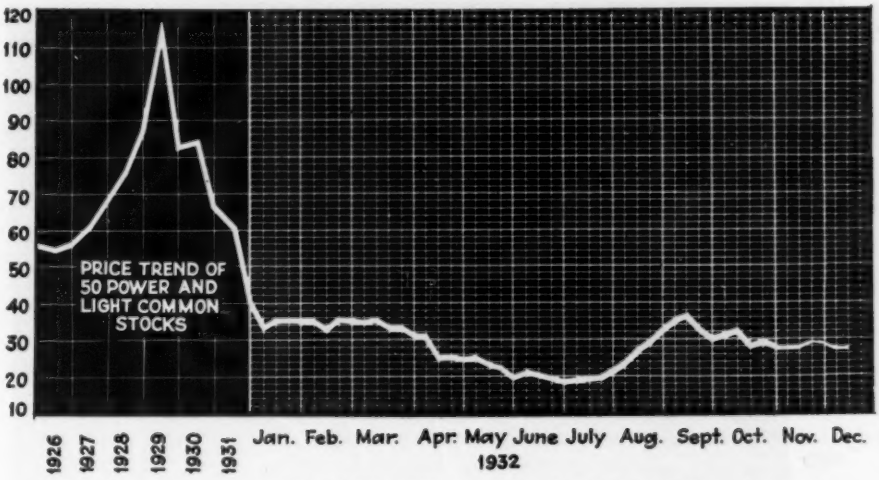
At the instance of the Missouri Public Service Commission the Kansas City Power & Light Company on December 1 terminated the management and engineering fee of 1 per cent on gross revenues which it had been paying for the last two years to the United Light & Power Engineering & Construction Company, a service unit of the United Light & Power System, of which the Kansas City company is a part. The percentage fee has cost the Kansas City property approximately $120,000 annually. Under the new plan the company will pay only on the basis of specific services actually received. It is estimated on the basis of standard fees a year's total will not exceed $60,000.

Free Lamps Made Optional by Commonwealth Edison

Reduction of 0.15 cent applying to all steps of its residential lighting rate without lamp service as an option to the existing rate, which includes a lamp service charge, has been filed by the Commonwealth Edison Company (Chicago) in accordance with an order issued by the Illinois Commerce Commission. The existing rate includes lamp service and has steps of 8, 6 and 3 cents with discounts of one cent per kilowatt-hour on the two top steps for prompt payment. The optional rate without lamp service will be 7.85, 5.85 and 2.85 cents with the same discounts.

Action upon the free-lamp policy of Commonwealth Edison Company has been pending for some months (ELECTRICAL WORLD, May 21, page 880, and July 2, page 8). The free-lamp system has prevailed in Chicago for many years.

Utility Stocks Firm



During the past week public utility stocks held firm, price changes being few. The "Electrical World" index was 27.6, as compared with 27.7 for the preceding week.

Central Public Service Bankruptcy Suit Filed

Alleging transference of properties from Central Public Service Company to the Consolidated Electric & Gas Corporation to have imperiled the security of their investments, three holders of $1,000 debenture notes of the former organization have petitioned the federal district court in Chicago to declare the company bankrupt. Central Public Service went through a reorganization last August, from which emerged a new top holding company, Central Public Utility, with Central Public Service, now a subsidiary, holding securities of the newly organized Consolidated Electric & Gas Corporation, to which certain southern properties of Central Public Service were transferred. The petition claims that the conveyance of these assets of Central Public Service was made with intention to defraud the petitioning and other debenture holders.

Following the filing of an application for receivers for the Central Public Service Corporation, which action preceded the petition in bankruptcy, Central Public Utility Corporation announced that the Central Public Service is not in default on any of its obligations and is believed to be entirely solvent. Its statement further says: "The readjustment plan of Central Public Service Corporation contemplated the eventual liquidation of the corporation, but desired this liquidation to be so handled as fully to protect all security holders rather than work to the advantage of any particular litigant."

Current Earnings Reports of Electric Light and Power Companies

Operating Companies

	1932	1931	Per Cent Increase	Operating Ratio 1932	Operating Ratio 1931
Alabama Power (Year ended September 30)					
Gross earnings	$16,081,791	$17,940,843	—10.4	48	48
Net earnings	8,347,700	9,357,233	—10.7	..	..
Net balance	1,416,294	2,723,038	—48.0	..	..
Consumers Power (Year ended October 31)					
Gross earnings	28,621,496	31,036,296	—7.8	51	52
Net earnings	14,153,472	15,060,887	—5.9	..	..
Net balance	5,563,391	7,141,942	—22.0	..	..
Georgia Power (Year ended September 30)					
Gross earnings	23,105,788	25,455,301	—9.3	50	59
Net earnings	11,654,630	11,624,874	Negl.	..	..
Net balance	2,565,039	3,026,921	—15.2	..	..
Kansas City Power & Light (Year ended October 31)					
Gross earnings	14,762,314	14,815,516	Negl.	60	59
Net earnings	5,929,681	6,021,549	Negl.	..	..
Net balance*	4,210,297	4,465,816	—5.8	..	..
Ohio Edison (Year ended October 31)					
Gross earnings	15,969,395	18,286,452	—12.4	46	46
Net earnings	8,597,084	9,857,291	—13.0	..	..
Net balance	3,017,732	4,546,292	—33.8	..	..
Pennsylvania Electric (Year ended September 30)					
Gross earnings	7,742,120	8,347,282	—7.7	66	62
Net earnings	2,597,198	3,397,764	—23.4	..	..
Net balance*	1,277,543	2,364,950	—46.0	..	..
Southern California Edison (Year ended October 31)					
Gross earnings	37,751,246	40,954,283	—7.8	31§	33§
Net earnings§	26,100,408	27,415,119	—4.5	..	..
Net balance†	19,062,800	20,510,107	—7.0	..	..
Tennessee Electric Power (Year ended September 30)					
Gross earnings	12,220,858	13,892,431	—12.0	58	59
Net earnings	5,094,510	5,686,397	—10.5	..	..
Net balance	936,092	1,933,991	—51.7	..	..

Holding Companies

	1932	1931	Per Cent Increase	Operating Ratio 1932	Operating Ratio 1931
Commonwealth & Southern & subsidiaries (Year ended October 31)					
Gross earnings	$117,201,643	$132,091,445	—11.3	53	54
Net balance	6,334,785	14,493,629	—56.4	..	..
Engineers Public Service and subsidiaries (Year ended September 30)					
Gross earnings	47,822,763	53,150,250	—10.0	63	64
Net balance	2,418,972	4,044,435	—40.0	..	..
National Power & Light and subsidiaries (Year ended September 30)					
Gross earnings	73,242,443	78,921,661	—7.2	60	61
Income from subsidiaries	10,245,776	12,202,107	—16.1	..	..
Net balance	7,432,961	9,352,355	—20.6	..	..
Philadelphia Company and subsidiaries (Year ended September 30)					
Gross earnings	50,954,490	59,551,758	—14.6	64	59
Net balance +	6,133,116	12,013,829	—49.2	..	..

+ Less than common dividend requirements.
* Balance available for preferred and common dividends.
§ Operating expenses do not include deductions for depreciation.
† Balance available for preferred and common dividends and depreciation.

Gross earnings — (Operating Companies) Gross operating revenue. (Holding Companies) Gross operating revenue plus other income. Net earnings — Earnings after deduction from gross earnings of operating expenses, taken to include taxes, depreciation, maintenance, operating, etc. Income from subsidiaries — Balance available from income of subsidiaries for holding company. Net balance — Balance available from income for common stock dividends.

Output Rise Less Than Normal

Instead of exceeding the output record of earlier weeks this autumn, in accordance with the normal seasonal rise, production of electrical energy in central stations during the week ended December 3 made only a partial recovery from the temporary recession occasioned by the Thanksgiving holiday. This, combined with a much greater rise last year, caused the gap between 1931 and 1932 output to widen again, to 9.6 per cent, after it had been reduced to 6.3 per cent a month ago. According to the National Electric Light Association 1,510,337,000 kw.-hr. was generated, against 1,475,268,000 kw.-hr. the week before and 1,671,466,000 kw.-hr. a year ago.

This relative set-back occurred in every region except on the Pacific coast but was most pronounced in New England, where for a time production was running close to 1931 figures, but is now down 7.3 per cent. The Atlantic seaboard and the Central industrial region also lost some of the ground recently gained.

Weekly Output, Millions of Kw.-Hr.

Week Ended	1932	1931	1930	1929
December 3.....	1,510	1,671	1,747	1,806
November 26.....	1,475	1,600	1,672	1,718
November 19.....	1,532	1,655	1,722	1,818
November 12.....	1,521	1,623	1,713	1,794
November 5.....	1,525	1,628	1,728	1,798

Per Cent Change from 1931

Region	Week Ended Dec. 3	Nov. 26	Nov. 19
Atlantic Seaboard.....	— 7.7	— 5.6	—7.0
New England alone..	— 7.3	— 3.7	—7.4
Central industrial.....	—12.3	—10.2	—9.2
Pacific Coast.....	— 7.9	— 7.9	—7.6
United States.....	— 9.6	— 7.8	—7.5

▼

Seasonal Energy Rise Reappears This Year

In contrast with the complete absence of the usual seasonal energy rise last year, average daily output of public utility plants this fall is gaining steadily. Total production in October, 7,044,000,000 kw.-hr., was off by a smaller percentage from 1931 than has been the case in other recent months. This is shown by the following statistics published by the U. S. Geological Survey:

Month	Kw.-Hr. (000,000)	Per Cent Change from 1931	Per Cent from Water Power 1931	1932
May.....	6,635	—13	41	45
June.....	6,549	—13	38	41
July.....	6,526	—16*	35	41
August.....	6,743	—12	32	38
September....	6,739	—11	29	36
October.....	7,044	— 9	27	39

*Fewer working days than in 1931.

While production from water power was 30 per cent greater than last year, that from fuel was about 24 per cent less. Regional totals show a number of improvements over September, generally limited, however, to a smaller deficiency compared with 1931 rather than an excess. Percentage changes from 1931 in October, with September figures in parentheses, were: New England, —10 (—8); Middle Atlantic, —7 (—9); East North Central, —10 (—13); West North Central, —13 (—10); South Atlantic, —12 (—14); East South Central, +4 (—6); West South Central, —14 (—12); Mountain, —24 (—20); Pacific, —7 (—8).

▼

Electric Service in German Cities

Information on electrical service in several hundred cities in Germany is contained in Special Circular No. 609, recently issued by the Electrical Equipment Division of the Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce. The circular covers all cities having a population of 20,000 or more, giving for each the name of the operating company, the generator capacity, the type of current, frequency and voltage of distribution circuits and the class of plant, i.e., steam, hydro-electric or internal combustion engine. It is one of a series giving similar information for various countries throughout the world.

▼

New Bedford Customers Complete Rate Case

Counsel representing the customers of the New Bedford (Mass.) Gas & Edison Light Company who petitioned the Massachusetts Department of Public Utilities for reduction in rates completed their case at the recently resumed hearings. Acting for the company, Attorney Robert Dodge stated that the people of New Bedford get almost the lowest bills of any consumers in the state, the average bill being $1.82 a month. The people, he said, are under the misapprehension that the company is making enormous profits. He testified that the profit of the company for the past twelve months was equivalent to less than 5 per cent on the book value of its assets and that with the $200,000 management fees eliminated, not 6 per cent on the value of the property would be shown. Mr. Dodge pointed out that since the war the company had reduced lighting rates eight times.

▼

World Power Congress to Meet in Stockholm

Stockholm has been selected as the meeting place for the 1933 sectional meeting of the World Power Conference, called to discuss the supply of energy to large-scale industrial establishments and transportation services, according to a report from Consul-General Roger C. Tredwell, Stockholm, made public last week by the Department of Commerce.

Sessions will open on June 28 and continue until July 7, it is stated. The subjects for discussion at the congress will be divided into two main groups. In the first group the subject matter will deal with the supplying of energy and power to industry and heat combinations, special energy problems of the iron and steel industry, electrical heating, and the conveyance and adaptation of driving power to industrial machinery. In the second group the supplying of electrical energy to transportation services, such as railways, town and suburban traffic and marine transportation, will be considered.

Missouri Project License Granted by Commission

Bringing to a close a long-drawn-out discussion, the Federal Power Commission on December 1 executed a major license to the Empire District Electric Company for a project on White River, Mo. The application for this license was pending for more than eight years before the predecessor commissions, the responsibility for the delays being somewhat evenly divided among the Federal Commission, the county and state officials and the company itself. The present commission notified the applicant company that it was ready to tender the standard form of major license, but acting upon the company's request for delay, time was granted for the preparation of a formal petition, and thereafter a hearing was ordered in May of the present year.

At the time of the hearing protests were filed by the local interests in Missouri against any further delay, while the applicant presented evidence showing the continuing decline of industrial demand for power in the area now adequately served by the present system. The commission took judicial notice of existing economic conditions, but, however, held that it was not vested with the broad discretionary powers urged by the applicant and, therefore, must deny the petition for further delay (ELECTRICAL WORLD, July 16, page 67). The plans and specifications for the project were approved and a license for a period of 50 years tendered subject to acceptance on or before December 1. The Empire District Electric Company filed its acceptance on November 29 and the license is now made effective.

The project includes a dam across White River at Table Rock in Taney County near the Arkansas line, and when completed the project, with the necessary substations and transmission lines, will involve an expenditure of $30,000,000. The proposed installation will be 220,000 hp.

▼

General Electric Forms New Company

Organization of the General Electric Contracts Corporation, to purchase from distributors and dealers installment payment obligations covering the sale of General Electric household appliances and other products, was announced last week by Gerard Swope, president of the General Electric Company. The initial operation of the new corporation will be in the New York metropolitan area and will be extended to other cities as service and volume of business require.

The commercial credit and other finance companies which have satisfactorily handled this business will continue to operate in all territories pending the opening of additional branches of the newly organized company. G. F. Mosher, assistant treasurer of the General Electric Company, has been named president of the corporation.

▼

New Cookery Prizes Announced by N.E.L.A.

Among the 1933 prize announcements of the National Electric Light Association are two awards of especial interest and significance to the program of the National Electric Cookery Council. The A. L. Lindemann award consists of cash prizes of $150, $100 and $50, for the most meritorious papers by employees of electric light and power company members of the National Electric Light Association dealing with the advantages of electric cookery. The subject of the essay is "The Advantages of Electric Cookery for Domestic Purposes." All papers, limited to a maximum of 1,000 words, must be submitted to the headquarters of the association on or before March 1, 1933.

With the purpose of stimulating interest in electric range sales and for advancing the use of modern equipment in the home kitchen the George A. Hughes award of a cup and $1,000 is offered in 1932 to the operating utility company and individuals in the company whose work and co-operative efforts show the greatest contribution to the development of the domestic electric cooking load, through promotion, or selling, or both, during any calendar year.

▼

Power Plant to Be Built in Egypt

One of the most important public power developments to be undertaken in Egypt in recent years is now under way with the building of a hydro-electric power plant at the Aswan Dam in connection with the work of raising the crest of the dam, according to the *Engineer*, London. The proposed generating station will have four turbine-driven generators of 40,000 kw. capacity each. It is proposed to use the power for the manufacture of nitrochalk and other artificial fertilizers, the surplus power being available for pumping and irrigation schemes in the Aswan and other provinces that now require more expensive and imported oil fuel and coal.

The power plant erection, which is to be financed by the Egyptian government, is expected to require four years, and as the fertilizer plant will require only two years for its construction it will not be started until a later date. Sir Murdock Macdonald & Partners, Westminster, England, are engineers for the Egyptian government.

Major New Construction This Week

Permission granted Empire District Electric Company, Joplin, Mo., for hydro-electric plant (220,000 hp.) on White River, Taney County, Mo. Project includes switching and power substations, with steel tower transmission line. Estimated cost over $25,000,000.

Until February 3, Bureau of Reclamation, Denver, Colo., asks bids for three, four or five vertical shaft hydraulic turbines (115,000 hp.); for one or two similar hydraulic turbines (55,000-hp.), for Hoover Dam power plant, Boulder City, Nev. (Specification 540.)

Bids asked by Fort Wayne, Ind., until January 5 for equipment for city-owned electric plant, including switchboards, transformers, circuit breakers, control system, distribution cabinets, underground duct, etc.

Oberlin, Ohio, having plans drawn for city-owned electric plant. Bond issue of $250,000 authorized.

Motors, machine drives, electric pumps, refrigerating equipment, transformer equipment, switchboard panels, etc., will be purchased for brewery of Vernon Brewing Company, Vernon, Calif. Cost about $160,000.

Rights-of-way being secured and work scheduled to begin in January on new transmission line from Salisbury to Crisfield, Md., by Eastern Shore Public Service Company, Salisbury. Estimated cost over $100,000.

▼

Niagara Hudson Drops Appliance Sales

Announcement was made last week that the Niagara Hudson Power Corporation has planned to discontinue the sale of electric and gas appliances throughout its territory, but efforts will be made to increase the use of electric current and gas by offering consulting service to customers on adequate wiring, home making and home lighting. The company's stores are to be converted into continuous electric and gas displays.

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New York Metal Prices

	Nov. 29, 1932 Cents per Pound	Dec. 6, 1932 Cents per Pound
Copper, electrolytic	5.25	5.25
Lead, Am. & S. R. price	3.00	3.00
Antimony	5.75	5.50
Nickel ingot	35.00	35.00
Zinc, spot	3.50	3.475
Tin, Straits	22.50	22.50
Aluminum, 99 per cent	23.30	23.30

South Carolina Rejects Rate Offer

A compromise offer on electric power rate reductions for South Carolina which would save consumers approximately $400,000 a year has been rejected by the South Carolina Railroad Commission. Duke Power Company and Southern Public Utilities Company sought to institute the same new rate schedule as was put in effect in North Carolina (ELECTRICAL WORLD, November 26, page 712). The commission is reported to have turned down the offer on the grounds that conditional clauses would place upon the commission the necessity of assuming legislative functions wholly beyond its scope.

▼

Thomasville (Ga.) Balks Sale Plan

Thomasville, Ga., City Council, determined not to sell out the city plant, has passed a resolution preventing the sale of the municipal electric plant unless approved by a two-thirds majority vote of the citizens in a special election held for the purpose.

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Penn Yan Continues Energy Gift

Following a custom instituted in 1930, the municipal plant of Penn Yan, N. Y., has sent receipted electric bills for December energy use to its customers, with the suggestion that the money be spent for holiday gifts.

▼

Stevens Tech Splits the Term

To avoid the unfortunate inactivity that must ensue in the case of preparatory school graduates who matriculate in mid-year and then find that under present conditions they have no occupation or income until college opens in the fall, Stevens Institute of Technology has this year adopted the plan of admitting students in February, arranging their schedules so that they may graduate with the class which entered in the previous September and charging the regular tuition.

▼

Competing Power an Alabama Issue

Alabama Power Company is threatened with competition by coal companies which protest excessive rates are being charged them and their employees. The right to erect transmission lines and sell surplus power was granted the fuel concerns by the last Legislature, on the provision that they qualify as public utilities. The Alabama Fuel & Iron Company has erected transmission lines, and although halted by an injunction obtained by the power company proposes to qualify and operate as a public utility. In its defense the power company points to steadily reduced rates over a period of years and mounting tax charges.

▼

Louisiana Commission Reorganized

Reorganization under Governor O. K. Allen of the Louisiana Public Service Commission has been effected through the qualification of Wade O. Martin of St. Martinville as a member to succeed Dudley J. Le Blanc and the election of Harvey G. Field, already a member, to succeed Francis Williams. Col. P. A. Frye, who has been traffic manager of the state highway commission, was chosen secretary of the commission to succeed James Helm, and Alex Grouchy, formerly mayor of Baton Rouge, was appointed as assistant secretary and general field representative.

▼

National planning will be the country's major task during the next ten years and the results may well be a stirring epic of human achievement. The objective of national planning in its economic aspect is to attain and maintain in the United States a standard of living that is high, broadly distributed and free from severe fluctuations. In its industrial aspect it is to stabilize the operating performance of industrial enterprises; in its national aspect it is to minimize the fluctuations of business and avert disaster.

LEON P. ALFORD
Vice-President
American Engineering Council

[Mr. Alford, addressing the opening session of the 53d annual meeting of the American Society of Mechanical Engineers in New York this week, also cited statistics showing the increase in productivity of American industrial wage earners since 1919. Between 1899-1919, the percentage rose only 4.7 per cent. From 1919 to 1927 there was an increase of 53.5 per cent.]

▼

Appraisal for Mitchell, Neb.

Nebraska Supreme Court has appointed three district judges to appraise the property at Mitchell, of the Western Public Service Company, over the protests of the corporation, which attacks the constitutionality of the law. The appointments were made in order to comply with a time limitation of the law. The appraisers will not start work until the validity of the statute has been passed upon by the court (ELECTRICAL WORLD, October 22, page 552).

▼

Pennsylvania Electrification

First round-trip test run on the electrified New York division of Pennsylvania Railroad was made December 1, when a four-car train was operated between Jersey City and Milltown, near New Brunswick. Regular service is expected to be in operation before the first of the year.

Reduced Rates in Indiana

Reduced rate schedules for electrical service in fourteen Indiana communities supplied by the Public Service Company of Indiana have been filed with the state Public Service Commission to take effect January 1. In each case the town authorities had agreed upon the new rates in conferences with the company officials. Both residential and commercial rates were involved in the new schedules.

▼

Yonkers Utility Must Change Records

In connection with the proceeding in which the Yonkers Electric Light & Power Company was authorized to issue 79,514 shares of its common stock to the New York Edison Company at a cost of not more than $3,975,700, the New York Public Service Commission has approved a report written by Milo R. Maltbie, chairman, recommending the adoption of an order requiring the Yonkers company to make certain changes in its accounts. The company's figures on fixed capital, it is said, should be on the basis of cost and not reproduction cost. The question of rates was not involved, Mr. Maltbie stated.

▼

Philadelphia Street Lights

In an effort to avert dismissal of thousands of city and county employees next year, the City Council of Philadelphia has effected, among other economies, a saving in the street-lighting estimates for 1933 of $765,000. This arbitrary cut was made over the objections of Director of Public Safety Dodge and Director of Public Works Caven, who urged that the matter be approached from an engineering standpoint. They were, however, over-ruled by the Council and as a result nearly one-fourth of the street lights must be extinguished. The directors of safety and public works had requested an appropriation of $3,090,000.

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Georgia Power Lamp Record

Most successful lamp campaign in the company's history, that of the Georgia Power Company during October saw 100,000 "Mazdas" placed. This is the third campaign pushed by this company this year and the total for the three approximates 180,000 units. Many quotas were exceeded, some by 81 per cent. The company record was 174.8 per cent of quota.

▼

New Rates Approved in Carolina

Alternative rate schedules for residential electric service for all territory served in North Carolina by the Carolina

Power & Light Company, effecting an annual reduction of more than $120,000, have been approved by the State Corporation Commission. The schedules were offered by the utility following conferences initiated by the commission (ELECTRICAL WORLD, October 29, page 579). One of the optional schedules provides for a charge of $1 a month and 5 cents per kilowatt-hour for all energy. The other provides for a charge of 10 cents per kilowatt-hour for the first 30 used each month and 6 cents for additional energy, with a minimum monthly bill of $1. The company is charged with the duty of billing each customer during the first year at the rate most favorable to him, and thereafter the customer may exercise his own option. The new rates became effective December 1.

▼

College Rowing Tank Requires 106,000 G.P.M.

Driven by two 41-in. bronze impellers water races through a 60-in. flow pipe to a head tank of the rowing trainer at the new Payne Whitney Gymnasium at Yale University and then flows under fully controlled velocity past the concrete boat and back to the foot tank. A smooth flow of water at high velocities is said to be obtained. Stream flows of 2 to 9½ miles an hour may be secured in numerous steps through push-button control.

Such tanks are said to offer marked advances over still water tanks by approaching actual river conditions and permitting regulation oars. A racing speed of 34 strokes per minute with technically perfect form, quick stroke and slow recovery is possible.

Motor-drive through Westinghouse 300-1,800-r.p.m., 100-hp., 230-volt d.c. motors is used; 6⅛ to 1 reduction gears are interposed between each motor and its impeller.

▼

18-Kw. Beacon to Top War Memorial

Dedication of a giant watch light on Mount Greylock, tribute to Massachusetts' war dead, will take place next June. Within a globe nearly 12 ft. in diameter placed on a 90-ft. granite shaft on the highest elevation in the state (3,505 ft.), the rays from twelve 1,500-watt floodlights will be visible in five states at a distance of 70 miles.

▼

Power Plant Survey for Mishawaka?

Growing sentiment in favor of a power plant survey in Mishawaka, Ind., has resulted in the arranging of a rate conference between city officials and representatives of the Indiana & Michigan Electric Company. For the past six months the company has failed, it is reported, to respond to the request of the Board of Public Works for a parley, but advised of the action favorable toward a survey, announcement is made that a conference is pending. Engineers have assured the City Council that there is no way of determining whether or not present rates are just without making the survey.

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Oil Burner Capacity Gains Point to Simpler Layouts

Improved arrangement of air supply features in oil-burning power plants enables the building of single burners which burn oil or sludge at a heat liberation rate of 100,000,000 B.t.u. per hour (equivalent to more than 5,000 lb. of the usual commercial grade of fuel oil), stated H. J. Klotz, assistant chief power engineer Stone & Webster Engineering Corporation, at a meeting last week of the Boston section of the American Society of Mechanical Engineers. According to Mr. Klotz this development will enable future high-capacity oil-fired steam-generating units to be built with a great reduction in the number of burners required, with resulting simplification in piping layout and operating routine. Only five years ago a burner with a capacity of 2,000 lb. of oil per hour was considered the maximum.

Proper furnace design, contended Mr. Klotz, is largely a matter of providing sufficient volume to prevent injurious impinging of flame. All-refractory settings of suitable materials have given satisfaction with oil firing with continuous rates of heat liberation up to about 4,000,000 B.t.u. per hour per foot of furnace width and 6,000,000 on short peaks. Above 4,000,000 some degree of wall cooling is necessary to reduce maintenance cost. The basis of heat liberation per foot of furnace width is preferable to the liberation per cubic foot as a comparison, as the latter figure is misleading when comparing furnaces of greatly varying heights.

The lower portions of the walls of the higher furnaces required for large capacity units benefit to a decreasing extent from the cooling effect of the boiler heating surface as the height of the walls is increased. This explains why some all-refractory settings under comparatively small boilers can be continuously operated with a reasonable refractory maintenance expense at heat releases of 40,000 to 50,000 B.t.u. per cubic foot of furnace volume when such rates would make refractory maintenance prohibitory in higher settings. Completely water-cooled furnaces, preferably with refractory-coated surfaces, are giving entirely satisfactory results with oil firing at all ratings up to the commercial maximum.

Turbine Oil Guaranteed for the Life of the Machine

Development of a turbine lubricating oil which does not react with air and does not change in use in the machine is announced by the Standard Oil Company of Indiana. So confident is this organization of the properties of the new lubricant that a written guarantee is supplied to the effect that no replacement will be required during the entire life of the turbine installation.

The guarantee, the company states, has been made to emphasize the economic value of the oil in reducing expenses of turbine operation. Extensive laboratory and field tests indicated to company chemists and engineers that virtually a perpetual life could be guaranteed reasonably for oil which proved entirely free of deterioration even in prolonged use.

This development eliminates the familiar necessity at more or less regular intervals of draining off and replacing the old turbine oil with the frequent necessity of partially dismantling the lubricating system and cleaning out the deposits formed there because of the action of the air on the oil at elevated temperatures.

▼

Steel Barrels Welded for 2 Cents of Energy

In about half a minute the electric welding equipment now used by the Globe Steel Barrel Company of Cleveland transforms a flat piece of metal into a cylindrical container. Non-electrical equipment formerly used required seven minutes for the same operation.

The 200-kw. single-phase machine operates on 460 volts and under normal production welds 14 gage sheet steel 35⅜ in. long for 0.446 kw.-hr. and a cost of 2.68 cents or 19 gage metal 30¼ in. long for 0.311 kw.-hr. and a cost of 2 cents. Actual welding is completed in about 7.2 seconds and is carried along the entire seam simultaneously.

▼

Many Technical Standards Reported

Greatest activity in the establishment of national technical standards since 1918 has been reported by Bancroft Gherardi, retiring president of the American Standards Association. In 1932 43 new national standards were approved by the association and 32 new projects were initiated. Close co-operation between industry and government in standardization work was reported on and commended by Mr. Gherardi. Government departments have been represented on technical standardization committees on an equal basis with all other groups concerned.

EDITORIALS

L.W.W.MORROW
Editor

The New England town meeting points the way

FOR three hundred years New England has been governed by the town meeting. It is a simple plan that was established by the hardy settlers in the early colonies, in which a day was set apart each year to establish laws and to elect their leaders. On that one day disputes were fought out in open argument and the rules were adopted and the people worked together under the rules for the balance of the year. It was a good system, which is the reason why it has survived so long. It was good because it set apart a time when everybody had his say and things were settled by common counsel in the common interest. Isn't there a thought in this for electrical men?

The electrical industry is, after all, a community of different kinds of men. There are class interests among the groups, both nationally and in each community. But the dominant interest lies in the prosperity of the industry as a whole in which all share. They are all vitally concerned with the rules and the leadership and they should have their say. But despite the good example of New England, no definite time has been set apart for a town meeting in this community. Electrical dealers, contractors, wholesalers, manufacturers and power company men have no regular occasion for coming together in each city to discuss the state of the business, to analyze problems and to argue policies, to set the rules for the ensuing year and to elect the leaders. Nor is there such a time and place appointed for the adjustment of national plans and policies. It is the greatest weakness in the organization of the industry today.

In the last year or two this need for political co-ordination between the major branches of the industry has been borne in upon electrical men as never before. Disputes between the power companies and the manufacturers and the power companies and the contractors and dealers have become more acute. The desire for harmony has grown because its need has become more apparent and a greater effort has been exerted to accomplish it. But the lack of an accepted time and place has been an obstacle. There is no town meeting where each one knows that he can stand on a basis of equality and have his say. And therefore he does not plan to make the issue there and the arguments go on throughout the year, with little evidence of progress to the ordinary observer and an apparent absence of order and finality in the process. Each year introduces new problems and the old problems persist.

Yet the problems of the electrical industry can be solved. Conflicting traditions and opposing interests can be adjusted. And they would be, if electrical men would regularly get together in each city and agree upon what they want to do and how. Out of local experience would come local policies. Out of these local policies the national plans would just naturally evolve. For after all, it is just an orderly procedure for self-government that the industry is waiting for. And it will come when electrical men stop talking about co-operation and unite in a plan of action.

Theories of breakdown

THERE are few problems in electric research which have received such constant experimental attack and speculation as that of the mechanism of the breakdown of insulation. The results of this constant pressure on the frontiers of knowledge have been most definite in the case of gases. The theory of ionization by collision, extended so as to include thermal influences, and leading to the ionic avalanche as the final stage of breakdown, is now commonly accepted for gases.

In the case of liquids the picture is less clear, but still fairly definite. The obscurity usually pertains to the less pure liquids, in which dissociated impurities, moisture and other influences cause current conductivity, loss and temperature elevation, lowering the breakdown and obscuring its fundamental character. For pure liquids, however, the saturation current region is easily shown, and also the rising current voltage relation similar to that in gases, and which is indicative of secondary ionization. Carried sufficiently far, this stage leads to breakdown, and it is commonly supposed that the final stages are due to vaporization, following local temperature elevation, with resulting gaseous ionization in the vapor spaces and consequent electronic avalanche, as suggested by Günther-Schulze.

In the case of solids the obscurity is naturally the greatest. Recent careful studies on crystals led to the suggestion by Rogowski that here the submicroscopic cleavages found in all crystals provide gas spaces in which gaseous ionization and electronic bombardment are the basic causes of failure. Moreover, the theory was general because of the occurrence of such minute spaces in all substances. This view has recently been attacked by Joffé, who has shown that the breakdown is the same for a given substance, in the crystalline, the amorphous and other conditions selected to vary the size and distribution of the internal cleavage spaces. One of the most recent contributions to this interesting question is that of Wideröe in a recent number of the *Archiv für Elektrotechnik,* who analyzes the electrical stability of the rock salt crystal lattice, and the energy necessary for its upset by electron impact. The results are compared with experiment and breakdown stresses as calculated and as found in experiment are of about the same order of magnitude. Thus in this case also the most recent evidence is that insulation failure takes place as the result of ionization by collision.

These refined experiments and theories are at first sight somewhat removed from the cold facts of breakdown in practice. Nevertheless, if as suggested by the foregoing, a reliable and general theory of the nature of breakdown is finally reached, a long step will have been made to a point where we can choose dielectric materials for particular purposes and know how to control them so as to insure their best performance.

Health aspects of air conditioning

UNDOUBTEDLY air conditioning involves a consideration of health as well as comfort. But many misconceptions exist as to just what can be done for health by air conditioning. The influence of clean air and of air balanced in interiors against exterior air as to temperature and humidity undoubtedly is effective against colds, respiratory organ irritations and other disturbances that come from exposure to dirty air and shocks to membranes in going from an interior air condition to an exterior.

But it is also claimed that the production of ozone or of ionized air affects health. The claims for ozone are sound except that human beings cannot live in ozone concentrations sufficient to have a bacteriological influence. It takes about thirteen parts of ozone to a million parts of air as a minimum to influence bacteria and human beings are injuriously affected by one or more parts of ozone in a million parts of air.

It is interesting, however, to consider the researches going on as to the effect of ionization in air on health. Present data show that positive ions produce feelings of dizziness, fatigue, headaches, nausea and roaring in the ears. Negative ions, however, produce exhilaration, reduce blood pressure, and appear to have a very salutary effect on respiration and heart action. Data are meager, however, and equipment to negatively ionize air is embryonic in a commercial sense. From the standpoint of health therefore present air-conditioning equipment can aid only because it makes clean air and controls interior temperature and humidity relative to conditions found in the exterior air.

Our Industry's Future

Electrical industry has a greater future than its past.
Counsels of defeat should not be accepted.
The principles to follow are clearly defined.

By GEORGE B. CORTELYOU*
President National Electric Light Association

A PEOPLE that has triumphed over one peril after another, including savage nature and savage men; that has developed on this continent the fairest and greatest nation of free men the world has ever seen, still retains enough of the pioneer spirit that it is not going down to defeat today before any enemy, visible or invisible.

The competent committee that arranged this program selected as the subject of my remarks this afternoon "Our Industry's Future." A rather large subject, presuming an attitude of mind on the part of the speaker in which he rarely if ever permits himself to indulge. I have never willingly assumed the rôle of prophet. It is a thankless one at best and is also extremely hazardous.

I can say, however, and in this I am sure we think along the same lines, that the electrical industry has a greater future than its great past, if it will profit by its mistakes—and all human enterprises register mistakes; if those who shape its policies are shaping them to an ever-increasing service to its customers, characterized by frankness, fair dealing, adequate publicity of its transactions; if it shall be honest with itself and with all those whose fortunes are linked with it in any capacity whatsoever.

It will be enough for our present purpose if we consider a few of the particular reasons which justify our faith in the future of the industry we serve and which has brought us here in such goodly numbers today.

Your very presence here is an earnest of that future. It indicates that in this great metropolitan center the various elements that together constitute the electrical industry—producing companies, manufacturing companies, jobbers, dealers, contractors—are imbued with a spirit of harmony and co-operation which sees in the approximation to an ideal the surest way to practical results. It is, in short, an example of that practical idealism which after all is the only kind of idealism that counts. The world has always been full of the impractical kind. It is of good augury for the future of our industry that its several parts, each essential to the proper functioning and well-being of the whole, should be so co-ordinated that they unite to produce a single ultimate result—the best service to the customer. This is the test by which all business organizations must be judged.

We can discern nothing on the horizon that indicates any limitations upon the continued growth and use of electricity; on the contrary, the whole trend of technical development seems to confirm the general impression that electricity is only on the threshold of its real growth and service to man. We have heard of industries that have been wiped out over night by a sudden shift in popular taste or fashion, or by some new product displacing the old. But if electricity is to be displaced in this manner, it will be by something whose very nature is as yet unknown and unsuspected and indeed unimaginable in the light of our present knowledge. So, so far as anything can be certain in an uncertain world, it is that the electrical industry will be a cornerstone of the country's future economic progress, and that what it has been is but a foretaste of what it is to be.

This does not mean, of course, that all will be clear sailing and that all we have to do is to wait for fortune's bounty to drop into our lap. Not at all. While the future of the electrical industry as a whole seems assured, individual units are subject to change, supersession and oblivion. Success must still be won by struggle and held on the same terms. Progress comes only by overcoming obstacles. As muscles that are not used become flabby, so organizations that are not actively striving for improvement inevitably decay. The successful business organization of the future will be the one that concentrates upon essentials, studies its markets, refuses to sacrifice quality to price, strengthens its research activities, cultivates employee morale, co-operates with other units of the industry, and if into the whole it is able to infuse an uplifting imagination, so much the better. Imagination may not rule the world, as Napoleon declared, but it certainly has a vast influence upon human affairs, including business.

As the electrical industry, and more particularly its utility branch, probably has more human contacts than any other, its welfare is bound up in the general welfare and its future depends upon the future of the people themselves in their occupations and industries. It cannot prosper in a state of widespread and long-continued adversity. It is as anxious as any other member of the community to see the return of normal times.

**Abstract of address before Electrical Association of New York, November 23, 1932.*

There are some "back to the land-ers" who would have us revive earlier times—when every individual built his own cabin, raised his own food, made his own clothes, and so on. Then everybody would be independent of everybody else and—having nothing to depress—immune to depressions. One thing they leave out of their calculations is the danger of an attack by the Indians.

These and other proposals of defeatism that are going the rounds—the gospel of those who have been aptly described as "the new quitters"—involving the resigning of ourselves to a permanently lower standard of living, surrendering the ground that we have won with so much painful effort, throwing overboard the achievements of science and invention which have enriched the life of the common man beyond anything hitherto known, accepting our lot as if it were a decree of fate, are not a solution, they are merely an abdication, and abdication does not "set" well on the American conscience.

We are not going to abdicate; we are going to rehabilitate. We are not on our way out; we are on our way back.

Now, the way back is never easy or pleasant, either for individuals or for nations. It is particularly hard for nations because of their greater mass and inertia, but while they may postpone the inevitable for a time by various devices, they must finally submit to it. The all-important question is, when, and how quickly? I wish I could answer this question. I do not believe there is any mortal man who can answer it. If there is, he is assuming a grave responsibility by withholding such exclusive and priceless information.

Our industrial plant is intact and efficient, capable of producing in profusion everything we need. There is no lack of capacity to provide for all the material wants of our people with a surplus left over, and other nations find themselves in the same position. Nor is there any lack of desire on the part of the people everywhere to possess the things which the industrial plant is so well able to supply. Yet there is this strange stoppage of the channels of trade and of exchange which has prostrated industry and thrown millions out of employment. Of course we know that much of this was by way of penalty for the excesses of the boom period, which produced its natural and necessary reaction, the whole being a legacy of the great war. We have been liquidating our mistakes for the past three years. Many things are still out of balance, but sufficient major adjustments have been made —so far as individuals are able to make them—for some of the effects to show, not many of them as yet to be sure, but enough to encourage the hope that we are now looking down at the trough of the wave from its rising slope. You know we passed the crest several months before anybody recognized it, and so we cannot be sure about the bottom until some time after we have passed it and gained a little perspective.

It seems to be an historic truth that great masses of people change their collective mind on controversial subjects only as a result of long and painful experience. How long and how much will they endure before sentiment crystallizes to the point where it will demand constructive action of a definite kind? We have seen how long it took and how much of strife, turmoil and suffering the people endured before they took a final and determined stand on the Eighteenth Amendment. Will they have to undergo a similar period of distress before they realize the altered aspects of the present economic crisis as part of a general world situation and demand specific action based on this premise? No, provided political statesmanship is sufficiently wise and bold to lead the procession and not wait to be prodded from the rear.

It is no shame to man to bow before the irresistible forces of nature. These in times past have taken their destructive toll, yet after each visitation man has always built anew. Shall he fail to do so now, when the difficulties in which he finds himself are in no wise the result of natural causes, but entirely of his own making? Shall it be said that he was more resourceful in repairing the ravages of nature than in repairing his own mistakes? To say that man who created the machine which is capable of producing such an abundance of material wealth, and which has enabled him largely to overcome the hostile forces of nature which so long menaced him, is now doomed to fall a victim to the machine he created is not only to place a low estimate on his intelligence, but is to deny him the very qualities with which it is necessary to endow him as creator of the machine. If man is in truth so impotent as to become the victim of his own creation, to be overwhelmed by his own power of productivity, then all that we can say is he deserves his fate.

Neither in the future of our industry nor in the future of our country can we envisage any such futility. It is repugnant to the American spirit, instinct and tradition. We reject it as false doctrine, because the historic aspirations of America, through the devotion of her sons and daughters and under the providence of God, for a better, freer and an ampler life are not doomed to frustration; they are destined to fulfillment.

▼

Power-Factor Correction Saved Cost in 18 Months

Monthly demand charges in the mill of the New England Pressed Steel Company, Natick, Mass., were reduced 37.6 per cent and the investment put on an eighteen months' amortization basis by the installation of a 60-hp. Fynn-Weichsel motor in place of a 30-hp. induction motor. The mill purchases energy from the Boston Edison Company and the demand charge is based on 80 per cent of the kva. or kw., according to which is greater. Owing to the nature of the operations in the mill, both the power factor and the load factor were very low when operating with induction motors alone, of which 212.5 hp. were in service in February, 1932. From February 29 to March 30 the total demand was 125 kva. The monthly demand charge was 100 kva., which at the current rate made the demand charge for the month in question $153.75. The mill power factor was 46 per cent.

The Fynn-Weichsel motor was substituted on April 15 and was installed with the brushes in the exciting circuit of the motor set for the maximum corrective effect. From May 31 to June 29 the total demand was reduced to 72.5 kva., and the monthly charge for 80 per cent of that figure, or 58 kva., was $96, a saving of $57.75 from March. The power factor was raised to 70 per cent. The cost of the exchange of motors was $1,068. Be-

sides the improvement in power factor the installation has also reduced interior wiring line losses and improved operation in the mill section served by this motor as a result of the maintenance of synchronous speed.

▼

Rotational Energy Tides Converter Over Power Failure

By L. W. HAYWARD
Power Superintendent
Tennessee Copper Company, Copperhill, Tenn.

Stored energy in a 300-kw. motor-generator set has been found sufficient to operate a d.c. tilting motor long enough to swing an 80-ton copper converter to the position where the copper would not freeze in the air tuyères as a result of a power interruption of more than one second. Interruptions in purchased power often determine whether an industry can afford to purchase power or generate its own energy. Power interruptions that last more than two seconds cannot be tolerated in certain processes. Such a case exists at the Tennessee Copper Company's smelter in connection with furnishing air for copper converters. Air for blowing the copper converter enters the molten mass through tuyères below the surface of the metal. A loss of air pressure, when the converter is in the blowing position, would allow the molten metal to run back into the tuyères and air duct. This would be disastrous as the tuyères would freeze and make further operation impossible. In case of a power interruption when motor-driven air blowers are used the converter has to be tilted and the tuyères brought above the metal line before the air pressure drops.

The copper converter is rotated by a d.c. motor geared to the converter. When a power interruption occurs the air blower motor stops and the air pressure falls to nothing. Our problem was to find some means to turn the converter after the power interruption, but before the air pressure fell sufficiently to allow the metal to run into the tuyères.

A 300-kw., 550-volt d.c., 1,200-r.p.m., synchronous motor-driven motor-generator set supplies the necessary d.c. power for operating the smelter cranes, smelter locomotives and for turning the converter. The motor for turning the converter is 65 hp., series wound, 500 volts d.c. In case of a loss of power it was necessary to obtain a source of energy to operate this 65-hp. tilter motor and also make its operation instantaneous upon any main power failure that might occur.

The flywheel effect in the 300-kw. motor-generator set was found to be sufficient to maintain d.c. voltage long enough to allow the 65-hp. tilting motor to rotate the converter and bring the tuyères above the metal line by a large margin before the voltage dropped too low.

To do this a number of automatic relays were installed. A master relay, which is the heart of the equipment, operates when a power interruption occurs and performs the following functions:

1. Opens the 300-kw. motor-generator motor oil switch, so as to prevent the synchronous motor from acting as a generator and pumping energy back into the a.c. bus and using up the stored rotating energy.
2. Disconnects all cranes and locomotives from d.c. generator, by opening main d.c. breaker, thus preventing these motors from using the stored energy of rotation.
3. Connects the 65-hp. tilting motor to d.c. generator and starts motor, thus turning the converter while the voltage dies down on generator.

The 65-hp. tilting motor will run about fifteen seconds on the stored energy in the motor-generator set, starting at full speed and gradually slowing down as the voltage on the motor-generator set decreases. This fifteen seconds of operation is sufficient to turn the converter tuyères out of the molten metal before loss of air pressure occurs. The tilting motor is normally hand operated and special relays were required to disconnect the motor from the hand control equipment at the time of the power interruption, to make its operation automatic and to return it to manual operation again after power is restored. After a power failure has occurred and the above sequence of operation has taken place the equipment is returned to its normal operating condition by hand.

The master relay which performs the above functions is of such design that it operates on severe voltage drops that would kick off the majority of plant motors, but does not operate on voltage drops that last for less than a second or that would not cause the synchronous motor-driven blower or motor-generator to pull out of step. The relay functions from reverse current in the converter air blower motor circuit. This motor is a 1,200-hp., 3,600-r.p.m., 2,300-volt synchronous unit. In case of a drop in voltage the motor tends to act as a generator and pump energy back into the station bus. This reverse current actuates the master relay, which is set for one second time delay. If the reverse current lasts for more than one second the relay trips and the tilting operation takes place, but if the voltage is restored in less than one second no relays function.

To prevent the blower motor and motor-generator from kicking off on small dips that do not trip the master relay time-delay undervoltage relays were installed on the motor switches so they will not open due to low voltage unless the voltage drop lasts more than two seconds.

This arrangement has worked very satisfactorily and over six months of operation the equipment has functioned properly on all power interruptions and has not functioned at times of short-voltage dips when the motors would normally continue to operate.

This solution was developed in co-operation with the Tennessee Electric Power Company, from which power is purchased, and has made possible the converting of a steam load into a purchase power load.

▼

Grid-Controlled Mercury-Arc Rectifiers for Railways

Rapid strides are expected in the near future in connection with electric transmission, according to Miles Walker,* president of the British Society for Advancement of Science. "Following fast on the construction of the national 132,000-volt lines and the Weir report, which showed what economies might be effected by the electrification of our railways, comes the wonderful development made possible by the grid-controlled mercury-vapor arc. The mercury-vapor arc (which for some years has been capable of carrying thousands of amperes) is now provided with a grid, much in the same way as

**Excerpt from speech before engineering section, B.S.A.S., York, England, August 21-September 7.*

a triode valve in a wireless set. Make the grid negative and no current will flow either way; make it positive and the arc acts as an ordinary valve. Thus, by connecting two grids to an alternating voltage, a pair of valves will deliver alternating current from a direct-current source. This makes possible the transmission of power at a d.c. pressure of 180,000 volts easier than when a.c. is used at 130,000 volts. It does away with many difficulties due to capacitance and inductance.

"Another application of this device is to change a power supply from one frequency to another. It is possible to take power from a single-phase trolley line and convert it into three-phase power at any frequency, so that three-phase motors can be started at a low frequency, and the number of cycles per second can be increased as the speed of the train rises. Moreover, the voltage can be regulated over a wide range, without the necessity of transformer taps. There are also great facilities for arresting the current on an accidental short circuit. This revolutionizes the possibilities with polyphase traction, and gives it some advantages over d.c. traction which were quite unexpected a year or two ago."

▼

A Time Saver in Street-Lighting Calculations

By J. J. DE LADE

Assistant General Foreman Street Lighting Department, United Electric Light & Power Company

To compute the number of hours that lamps have burned when removed from service for any cause, so their remaining economic life can be determined, and to establish periodic or zone-change schedules for taking lamps out of service when they have passed their efficient life, the United Electric Light & Power Company is using the "circular slide rule" illustrated. It was developed years ago and has been in daily use ever since. About 11,000 calculations of the first character mentioned have to be made per year, which would require about 5,500 man-hours if performed manually with the aid of an adding machine, whereas this dial performs the same calculations in about 183 man-hours, or one-thirtieth of the time.

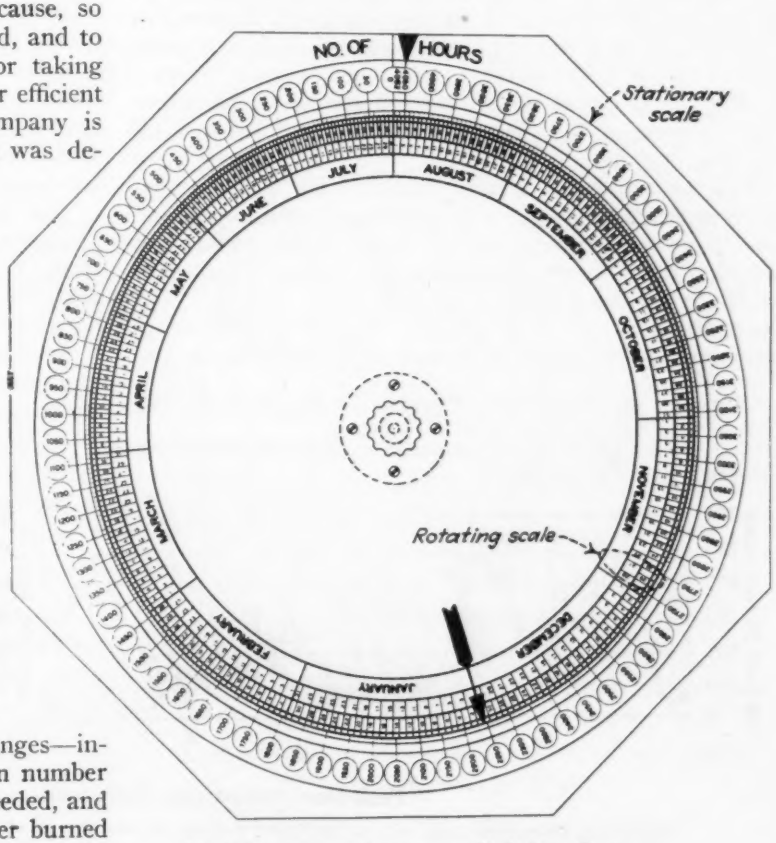
Calculations of the hours which a lamp has burned may be illustrated by an example. Assume that a street lamp of any rating was placed in service January 1 and removed due to burnout or breakage August 3 of the same year. Turn the central rotating dial until August 3 falls opposite the arrow at the top of the scale marked 4,050 (or 4,062 in a Leap Year). Opposite January 1 is directly shown the number of hours (2,243) the lamp has burned according to the New York City street-lighting schedule.

Another use—making periodic or zone changes—involves allotting a certain type of lamp a given number of hours to burn before the efficient life is exceeded, and then removing all such lamps in groups whether burned out or not. The date when a group or zone is to be removed is computed as follows: Place the date the lamps were installed opposite the number of hours they were supposed to burn and the date for the next change will appear opposite the arrow at the top of the dial marked 4,050 (or 4,062 in case of a Leap Year).

The dial is used every day to compute the number of hours the lamps have burned which were removed the night before. Approximately 30 such calculations are made per day each day in the year. We find this dial a time saver as we keep a record of the number of lamps placed in each socket or lamp-post and the number of hours each lamp burns.

Any one considering the use of this dial should remember that it is based on New York City street-lighting schedule aggregating 4,050 hours a year or 4,062 hours in Leap Years. Furthermore the non-uniform divisions of the central rotating scale are dependent on the daily hours of darkness, which differ for different parts of the country.

However, it is simple to make a dial adaptable to other conditions. First a time table should be prepared for the whole year from the street-lighting schedule, indicating for every second or third day the latest time for lighting and the earliest time for extinguishing the lights. From this table can be calculated the burning hours per day as well as the total hours for a normal year and also a Leap Year. Then the outer stationary scale is evenly divided into as many divisions as there are total burning hours in a Leap Year, allowing each space to represent ten hours. Next the inner rotary scale is marked off in days of the month by starting at zero hours, and indicating the date to be marked on the rotary scale opposite the accumulated burning hours up to and including that date since the first of the year.



Dial for computing street-lighting data

Experience with Rectifiers on Piedmont Northern

By W. T. GILL* and H. A. ROSE†

- 100 per cent service availability.
- No backfires despite 400 per cent overloads.
- Space saving and operating economies.
- High-speed re-establishment of arc.
- Shares excess overloads with adjacent stations.
- Facilities for treating-out and maintaining vacuum.
- Telephone interference avoided.

WITH a 100 per cent service availability record, a new design of mercury-arc rectifier has operated for over a year in unattended automatic service supplying 1,500-volt direct-current power for the traction loads on the Piedmont & Northern Railroad at Greenville, S. C. There have been no backfires, although momentary loads as high as 400 per cent have occurred and fifteen-minute demands in the order of 200 per cent are common. The loads during the heavier seasons have been somewhat greater than originally contemplated, but the rectifier has thus far demonstrated its ability to handle them. Very marked gains in conversion efficiency have been made. The equipment was placed in regular service immediately following 14½ hours of treating-out of the rectifier at low voltage.

The rectifier itself differs from previous practice in various ways which have been described previously. In general, the departure is in the design to control and guide the flow of vapor from the cathode to the condensing walls and in the location of the anode structures with relation to the vapor stream, upon which the superior quality of operation depends. Although great advantage had been secured through this new principle at the time this equipment was installed, still further improvements have recently been made. The unit is rated at 750 kw. at 1,500 volts d.c. and receives power from a double three-phase main and interphase transformer arrangement, giving the equivalent of six-phase over-all rectifier operation.

Load demands are characteristic of those for heavy-duty interurban freight and passenger trains operating over mountain grades each way from the substation. In addition to the heavy main line demands, power is supplied for switching in the Greenville yards near by. The base switcher load is of a highly fluctuating and recurring nature. A typical peak-hour load and a chart constructed from an actual 24-hour graphic ammeter record are illustrated.

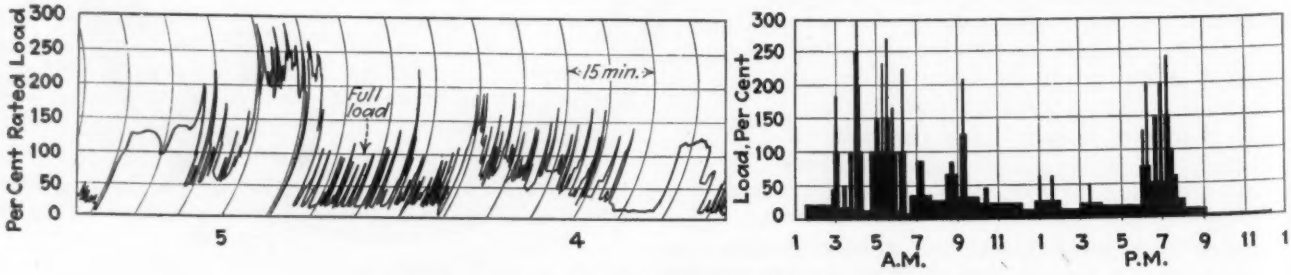
Two liberally rated 500-kw., three-unit motor-generator sets formerly supplied this load. Both machines were required for the freight movements so outage of one set would result in traffic curtailment. The rectifier carries the entire station load, the motor-generators serving as spare capacity in case of rectifier outage. The fairly high resistance to the adjacent substations materially limits the power which can be supplied from them in emergencies, and then only at much reduced train speeds. This condition, together with practically continuous switching load, requires the equivalent of a two-unit station at Greenville. Since the rectifier was installed there have been no outages requiring use of the motor-generators.

The accompanying table gives 60-, 15-, 10-, 5- and 1-minute average and maximum load demands on the rectifier for the month of February, 1932, which is representative of the heavier load season. The overload capacity of the rectifier is well demonstrated.

Service conditions at Greenville are such that maximum over-all economies are possible through the use of mercury-arc rectifiers. The more important of these are: (a) High direct-current output voltage (1,500 volts d.c.); (b) light average operating load as compared

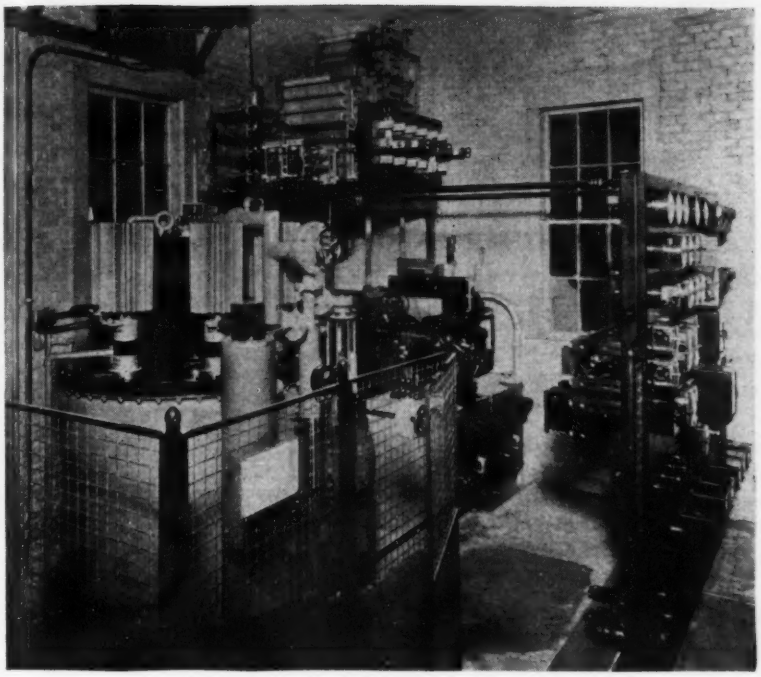
*Assistant general manager Piedmont & Northern Railway Company. Article received May 27, 1932.

†Substation engineer Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.



Peak-load period and daily load cycle on rectifiers

Maximum 60-minute load = 110 per cent rating; fifteen-minute = 180 per cent; ten-minute = 220 per cent; five-minute = 230 per cent; one-minute = 285 per cent



750-kw. rectifier and auxiliaries accommodated in small space

The projected floor space occupied by the installed indoor equipment is 13 ft. 9 in. x 13 ft. 4 in. Total indoor space provided for future two-unit substation is 27 ft. x 17 ft. 8 in.

to the maximum demands which determine the machine rating; (c) service conditions such as to require a practically continuous supply of power at the bus; (d) service conditions permitting unattended automatic operation, reducing operating expense; (e) nature of load resulting in considerable wear of current-collecting parts for rotating types of conversion equipment.

A comparison of the over-all losses from the a.c. to the d.c. buses with the motor-generators and with the mercury-arc rectifier is shown in an accompanying illustration. Average operating efficiencies obtained from input-output kilowatt-hour tests show 65 per cent for the motor-generators as compared to 94 per cent for the rectifier for approximately the same loads. On the basis of these savings in conversion losses and other operating expenses it is expected that the equipment will pay for the capital expenditure in about four years.

One of the principal advantages of rectifier equipment is the comparatively small amount of building space required for the indoor equipment. An illustration shows the space occupied by present equipment and that planned for a second rectifier, which will release considerable building space for other purposes.

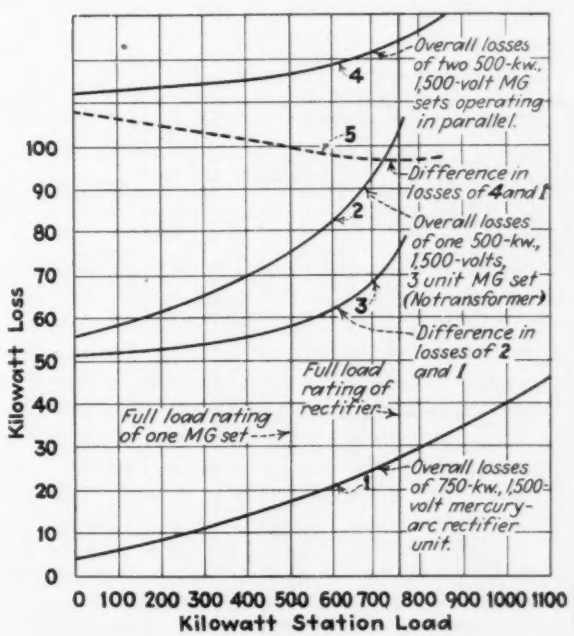
The rectifier and transformer combination has a 5 per cent shunt on drooping voltage characteristic with load from 0.4 per cent to the full load rating. For extremely light loads the voltage gradually rises to a value of 15 per cent over voltage at zero load. A new feature used in the interphase transformer design makes it possible to reduce the value of d.c. load at which the rise in voltage starts to exceptionally low values of the order of that taken by the control relays. The improvement practically eliminates this otherwise objectionable feature without the need for complicated power-consuming accessories.

To conserve losses, the excitation arc is automatically extinguished for all loads in excess of that required for arc stability on the main anodes. The excitation arc is discontinued after a short time delay when the load rises above the predetermined value, but is restruck instantly should the load drop below this value. The excitation arc is re-established about 100 times per day on the present Greenville load.

Power for ignition and excitation of the rectifier is supplied by a special-design high-current capacity "Rectox" rectifier. This makes it possible to obtain all of the advantages of direct-current excitation and ignition in a single anode without the use of rotating equipment and permits high-speed re-establishment of the excitation arc when the load drops suddenly from higher values to below the excitation-control relay setting.

When the rectifier load exceeds 300 per cent of rating load-shifting resistors are automatically inserted between the rectifier cathode and the positive bus to effect a 15 per cent drooping voltage output characteristic. In this way a portion of extreme overloads is shifted to the adjacent substations. Single-pole, double-throw knife switches permit convenient adjustment of load-shifting resistance and rectifier current during the treating-out process.

A terminal chamber on the side of the main transformer tank contains a link arrangement which makes it readily possible to shift the anode leads from the normal 1,500-volt connection to low-voltage taps on the secondary. This eliminates the need for separate treating-out transformer equipment.


Overall losses of two 500-kw., 1,500-volt MG sets operating in parallel.
Difference in losses of 4 and 1
Overall losses of one 500-kw., 1,500-volts, 3 unit MG set (No transformer)
Difference in losses of 2 and 1
Full load rating of rectifier
Full load rating of one MG set
Overall losses of 750-kw., 1,500-volt mercury-arc rectifier unit.
Kilowatt Loss
Kilowatt Station Load
0 100 200 300 400 500 600 700 800 900 1000 1100
0 10 20 30 40 50 60 70 80 90 100

Comparison of over-all losses with motor-generators and rectifiers

The heavier loads were formerly carried by two motor-generator sets operating in parallel

Average and Maximum Demands for One to 60-Minute Intervals for Heavy-Load Month

(Applies to February, 1932)

Load duration, minutes.....	60	15	10	5	1	Avg.
Average for month, per cent of full load...	93.1	141	165	188	279	32.6*
Maximum for month, per cent of full load..	155	190	220	245	400	40.2†

*Average for month. †Average for maximum day.

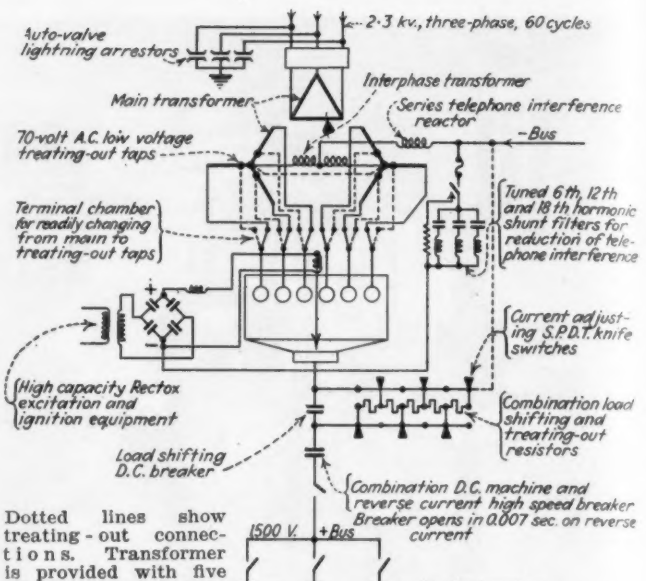
A combination of an iron-core series current reactor in the negative bus and shunt filters tuned for sixth, twelfth and eighteenth harmonic voltages reduces the harmonic current ripple from the substation to a value that permits satisfactory inductive co-ordination with the communication circuits. Two full-metallic telephone circuits used for train dispatching and company business parallel the power cables on the same poles.

A single high-speed circuit breaker serves the dual purpose of a high-speed breaker to disconnect the rectifier in case of backfire and as the ordinary slow-speed machine breaker. This breaker is held closed from the a.c. control supply by direct current from a small "Rectox" rectifier.

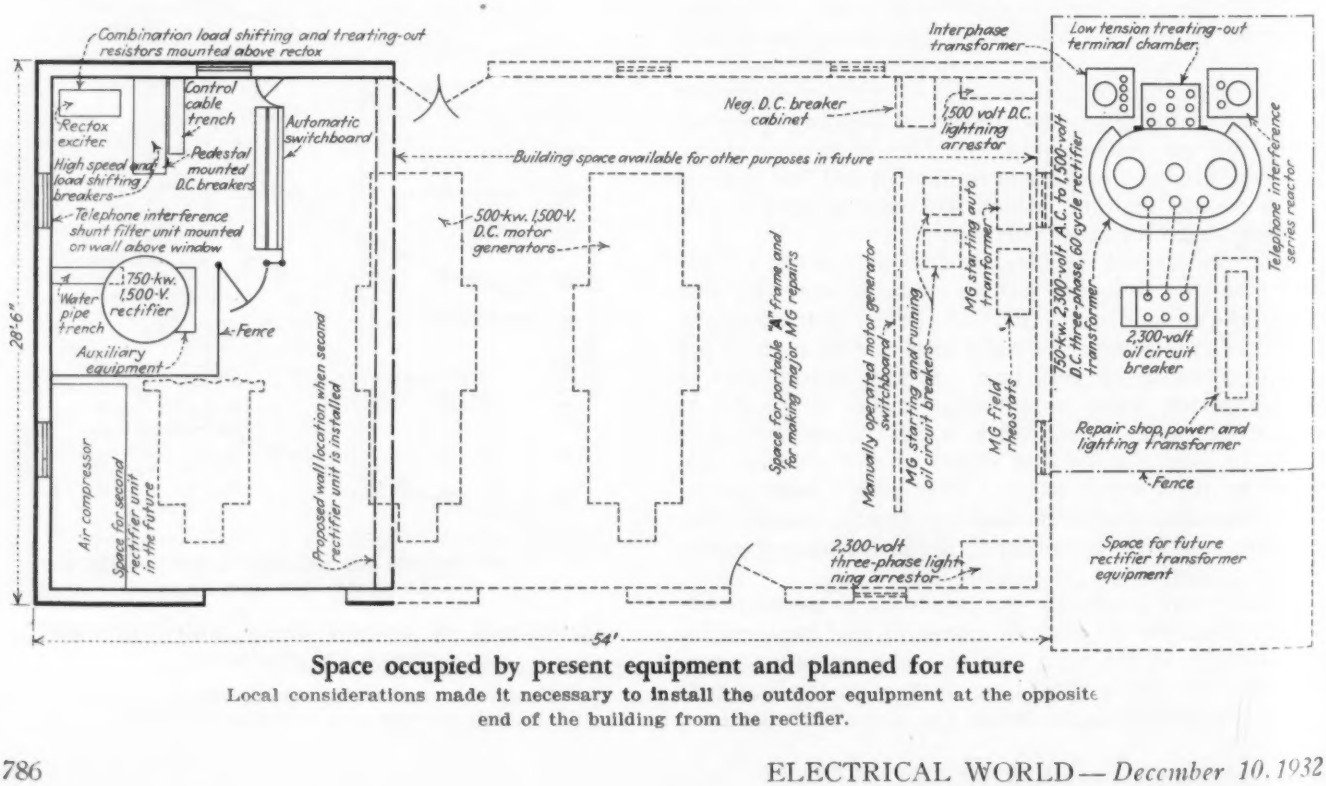
The load-shifting breaker and high-speed machine breaker with the rest of the heavy power circuits are located apart from the automatic switchboard on a concrete pedestal. This arrangement removes from the switchboard the vibration incident to the operation of heavy switches, prevents accidental heavy power arcs from burning small wiring and damaging the switchboard-mounted devices and increases the safety of regular equipment inspection.

The facilities for producing and maintaining the necessary vacuum in the rectifier are of particular importance. A high capacity multi-stage mercury vapor pump operates continuously to maintain the vacuum within the arc chamber, pumping the gases through a barometric seal into a collector tank or interstage reservoir. The gases accumulate here until the pressure in the interstage reservoir reaches a predetermined value, at which time contacts of a mercury manometer close to start the motor of the rotary oil-sealed vacuum pump. As the pump comes up to speed, a speed switch on the motor shaft operates to energize a solenoid-operated poppet-type vacuum valve in the line between the interstage reservoir and the pump. The interstage reservoir pressure is reduced by the rotary pump until the manometer opens another contact, which causes the pump to stop and the automatic vacuum valve to close as the pump speed decreases.

This system of vacuum pumping insures that the mercury vapor pump operates within very narrow and favorable back-pressure limits, which inherently maintains the rectifier at a constant pressure and as free of gas as possible. The barometric seal within the interstage reser-


2·3 kv., three-phase, 60 cycles
Auto-valve lightning arrestors
Interphase transformer
Main transformer
Series telephone interference reactor
-Bus
70-volt A.C. low voltage treating-out taps
Terminal chamber for readily changing from main to treating-out taps
Tuned 6th, 12th and 18th harmonic shunt filters for reduction of telephone interference
Current adjusting S.P.D.T. knife switches
High capacity Rectox excitation and ignition equipment
Combination load shifting and treating-out resistors
Load shifting D.C. breaker
Combination D.C. machine and reverse current high speed breaker
Breaker opens in 0.007 sec. on reverse current
1500 V.
+Bus
Feeder breakers
Dotted lines show treating-out connections. Transformer is provided with five 5.9 per cent overvoltage high-tension taps and hand-operated tap changer.

Power circuits for 750-kw., 1,500 volt rectifier


Combination load shifting and treating-out resistors mounted above rectox
Rectox exciter
Control cable trench
Automatic switchboard
Pedestal mounted D.C. breakers
High speed and load shifting breakers
Telephone interference shunt filter unit mounted on wall above window
750-kw. 1,500-V. rectifier
Water pipe trench
Fence
Auxiliary equipment
28'-6"
Air compressor
Space for second rectifier unit in the future
Proposed wall location when second rectifier unit is installed
Building space available for other purposes in future
500-kw. 1,500-V. D.C. motor generators
Neg. D.C. breaker cabinet
1,500 volt D.C. lightning arrestor
Interphase transformer
Low tension treating-out terminal chamber
Space for portable "A" frame and for making major MG repairs
Manually operated motor generator switchboard
MG starting and running oil circuit breakers
MG starting auto tranformer
MG field rheostats
750-kw. 2,300-volt A.C. to 1,500-volt D.C. three-phase, 60 cycle rectifier transformer
Telephone interference series reactor
2,300-volt oil circuit breaker
Repair shop, power and lighting transformer
Fence
2,300-volt three-phase lightning arrestor
Space for future rectifier transformer equipment
54'

Space occupied by present equipment and planned for future

Local considerations made it necessary to install the outdoor equipment at the opposite end of the building from the rectifier.

voir eliminates any possibility of atmospheric pressure or the interstage reservoir pressure forcing air into the rectifier as a result of failure of any of the parts of the vacuum system.

A hot-wire or electric vacuum gage checks continuously the degree of vacuum within the rectifier. A contact on this device causes shutdown of the rectifier in case of excessive pressure. Another contact allows the unit to restart as soon as satisfactory vacuum conditions are re-established.

The equipment was given complete combination tests at the factory prior to shipment. These included operation on overload cycles approximating the Greenville demands and a large number of short circuits and special overloads of short-time duration. These tests and the care given the design of the complete combination were reflected in the short time of 14½ hours required to place the station in regular service following completion of the installation work.

According to the methods adopted by the American Electric Railway Association for comparing the operation of mercury-arc rectifier equipments, the Greenville equipment has had a record of 100 per cent availability for service, including complete freedom from backfire. The station has been continuously available for service except for a few minor outages chargeable to apparatus other than the rectifier and its auxiliaries.

▼

Eliminating Radio Interference from Pin Type Insulators

By G. W. BARROW
Engineering Department,
Westinghouse Electric & Manufacturing Company, Derry, Pa.

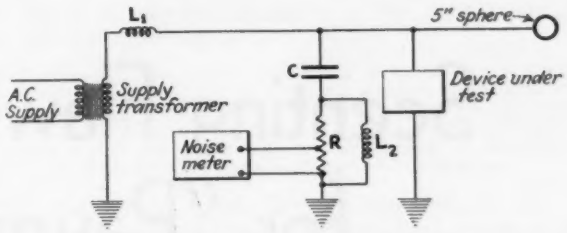
In general, insulators in good serviceable condition are considered to be free from radio interference, but for cases where improvement is desired insulators with special treatment to reduce the noise level are available. An arcing discharge is known to be a fertile source of radio interference. This may occur on pin type insulators, varying from soft corona at some points to arcing streamers at others.

High contact resistance exists between the ordinary insulator and the usual combination of conductor and tie wire. This results in small, but numerous, severe arcing discharges for the flow of the charging current from the wires to the insulator. The same condition exists to a lesser degree between a pin supporting the insulator and the porcelain threads in the pin hole of the insulator. Use of a grounded or ungrounded pin for supporting the insulator affects the electrostatic field and is another factor. These are considered to be the major factors contributing to any disturbance by the insulator.

Treatment to reduce the radio noise level consists of a special ceramic glaze which is applied to the top side of the head of the insulator. This glaze permits the development of a metallic coating molecularly attached to the porcelain over the wire groove areas. A low-resistance contact is thereby provided with the conductor and the tie wire which eliminates the corona and arcing flow of charging current. The characteristics of the glaze also damp out any discharge between the metallic developed portion and the undeveloped portion of the glaze. The use of any of the current designs of metal thimbles cemented into the insulator pin hole eliminates the discharge between the pin and the porcelain thread through the action of the cement filling all of the interstices between the porcelain and metal thimble.

Treatment Raises Inception Voltage for Interference

Pin Insulator	Kv. Grounded	Kv. Ungrounded
2-part, 15-kv. regular with thimble	9	18
treated with thimble	22	50
2-part, 22-kv. regular with thimble	9	19
treated with thimble	24	47
2-part, 33-kv. regular with thimble	10	21
treated with thimble	28	52
2-part, 44-kv. regular with thimble	10	20
treated with thimble	40	51
3-part, 60-kv. regular with thimble	9	18
treated with thimble	41	50

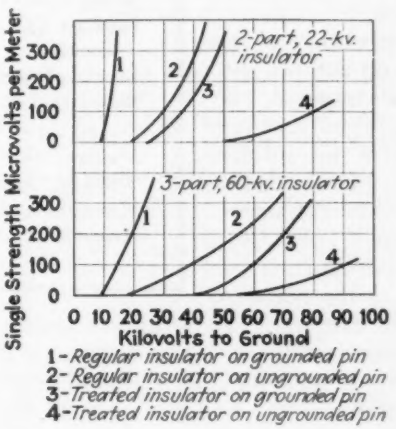


Testing pin insulators for radio interference

Voltage is applied by a regulator and transformer through a radio frequency choke coil L_1 to a ¾-in. diameter pipe bus. The other end of the bus conductor terminates in a sphere. This gives the effect of a conductor of infinite length, isolated from any other source of interference than the device under test. A condenser C is attached to the bus. The 60-cycle charging current flows to ground through RF choke coil L_2. The condenser readily passes any radio frequency energy generated by the insulator, which is caused by radio-frequency coil L_2 to flow through resistance R. This has a value of 250 ohms, approximating the impedance of a conductor of infinite length at radio frequency.

A radio receiving set is connected to the resistance, used as a potentiometer, for measuring the radio-frequency voltage. The potentiometer connection for the values given in the table and curve was adjusted so that the signal strength at 1,000 kc. for a given voltage equaled that obtained with a tuned loop located within 8 ft. of the conductor and calibrated to register in microvolts per meter. The values in the table and curves are therefore equivalent to an 8-ft. coupling between the insulator and receiver, which is probably more critical than any service condition.

With this set-up, voltage is applied to the insulator and increased until the signal is heard in an earphone headset. This is usually too small in value to be measured by meter. It is considered the starting value and further increase in voltage gives the signal strength values of the curves.



Pin grounding lowers and surface treatment raises interference threshold of pin insulators

Scenting Flaws in Proposals for "Payment Out of Savings"

By DEAN W. TAYLOR*
Utility Management Corporation, New York, N. Y.

DECISION whether to use privately generated power or power purchased from the utility company should be based solely on demonstrable economic criteria. Whenever this is done conscientiously the power utilities can have no quarrel with either the customer or the engine company. Whatever is honestly best for the power user must be best for the utility company, and for that matter, the engine company, too. If, then, all negotiations were known to be conducted on that high plane of unselfish devotion to the cause of electric power, no matter how or where generated, there would be no occasion for critical analysis of the ethics, motivation and methods in competitive situations in the power field.

Unfortunately, however, many decisions are made which do not rest on a full disclosure of all the economic considerations. This is a broad statement which can perhaps best be substantiated by analysis of a specific illustration, which, however, has characteristics typical of a group. The case in point is the keen competition imposed on power companies by the manufacturers of uniflow steam engines. The superior economy of the uniflow engine over small-sized steam turbines and other types of engines has been its chief claim to merit from an engineering standpoint. And yet some of the stiffest utility competition from uniflow engines is generally found in cases where process or building heating steam is an important item and where a generating unit with a higher water rate and a lower first cost would ordinarily be considered more economical. It may properly be inferred, therefore, that many uniflow engines have been sold for applications better suited to turbines or engines with higher water rates and lower first cost. What, then, are the compelling inducements in closing these sales? What are the flaws in these inducements from the standpoint of the purchaser and the utility company, analyzed on the premise that whatever is in the interest of the customer is also best in the long run for the utility company?

Many uniflow engine installations appear to have resulted from the salesmanship of the engine companies, and this salesmanship has been centered around purchase contracts of the so-called "payment-out-of-savings" kind. The significant thing about many of these contracts has been the lack of any guarantee of savings over the life of the equipment. In fact, the contracts are, frequently, merely deferred payment agreements secured by the credit of the purchaser. The only place where savings enter the picture at all is that if the savings, based on a short test run, are less than estimated, the final payments are deferred, with interest added up to the time limit of the contract. An engine installed on a payment-out-of-savings contract is an engine bought. The purchaser must use his credit the same as though he borrowed the money at the bank. There is no guarantee of over-all savings and no protection is given the purchaser against shrinkage of energy output and consequent shrinkage in any possible savings. The items of insurance and taxes are generally overlooked, along with provision for adequate reserve equipment, maintenance, attendance, labor and supplies.

The savings from use of these engines are sometimes advertised as being as much as 89 per cent, 131 per cent or even 200 per cent per year. As a matter of fact, using the manufacturer's published figures on investment, including necessary boiler room as well as engine room changes, the savings after adequate fixed charges may frequently be less than nothing. In some cases where uniflow engines have been installed to replace purchased power the customer has had to lay out from two to three times as much money for boiler room and other changes as for the engines themselves. *If the customer could have been induced to spend this extra amount of money in modernizing his boiler plant and in his utilization of steam in the factory, it is likely his savings would have been several times as great as those claimed from the installation of new engines.*

The tactics used in selling many uniflow engines, like those used in selling many Diesel engines, have been built on the psychological factor that people are prone to want to believe that something new must necessarily be better than their present arrangement, particularly if the seller is apparently willing to assume all the risk of financing and to wait for his money until the engine has "paid for itself." Sometimes the customer is induced to believe that he is being overcharged by the power company and that it would "serve the power company right" to lose a good customer. It seldom occurs to him that if he should make a mistake by purchasing an engine the power company would be the smaller loser of the two.

Subjects Covered in This Series

Retaining Existing Customers.[1]
Sifting Power Prospects.[2]
Payment-Out-of-Savings Engine Contracts.
Meeting Diesel Competition.
Where to Begin Sales Approach.
Process Steam — an Opportunity.
Making Power Reports Effective.
When the Odds Are Against You.
Yardsticks for Power Sales.
Power Sales Management.

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[1]*Published October 22, 1932.* [2]*November 19, 1932.*

When the power salesman meets this kind of competition his best arguments can be built around the engine contract itself, showing the customer wherein the contract is one of straight sale and not of guaranteed savings. Let us examine an actual contract submitted to a central-station customer who was told that he would be able to pay for these engines out of the savings made by ceasing the purchase of power. Some of the numbered items have been omitted because they are of a routine technical or legal character calling for no particular comment. The italics are mine.

————Company,
New York.
Gentlemen:

1. Subject to the attached specifications, which are made a part hereof, we propose to furnish you the following equipment:

1 18x16-in. three-cylinder, heavy-duty, vertical uniflow engine, operating at a speed of 327 r.p.m.

1 750-kva., 600-kw., 40 deg. rise, three-phase, 60-cycle, 240-volt, alternating-current generator, for direct connection to the above-named engine.

1 13½-kw., 1,150-r.p.m. Texrope-driven exciter unit.

1 13x15-in. heavy-duty, center-crank engine, operating at a speed of 257 r.p.m.

1 75-kw. direct-current, two-wire, 250-volt generator, for direct connection to above-named engine.

for the sum of.....$36,401.00

f.o.b. care of factories, with freight allowed.

This price includes the shipping of engine shafts to generator builder's plant and the pressing of rotors on the engine shafts.

The purchase price (on which the savings are based and toward which they are applied) includes only the equipment itself. The purchaser must unload, erect and install the entire installation, including piping and foundations. It is not unusual for the installation costs to exceed 25 per cent of the cost of the equipment itself, particularly where the existing boiler plant has not been providing steam for power generation and where substantial changes in piping and other equipment are generally necessary. If we add $9,000 for erection and installation and cost of test run we have a total investment of $45,400.

This customer's actual demand was 598 kw., yet the engine company proposed to replace central-station service with a *single* 600-kw. unit. No provision was made for either a spare unit or for breakdown service from the central station. This latter service would cost the purchaser $3,036 per year. A spare unit would cost even more.

Payments

2. You are to make us a cash payment of.....$1.00 upon shipment of the equipment.

3. The remainder, namely,.....$36,400.00 shall be known as the deferred payment and shall be remitted to us in monthly amounts representing the saving we can prove this equipment will effect in your plant, against the cost of purchased central-station current combined with the cost of generating live steam for heating purposes; the saving to be determined by an operating run on the equipment we are proposing to furnish after it has been placed in operation, which operating run is hereinafter described.

The small down payment is a skillful inducement in itself as well as making the contract binding by its payment. The savings are to be determined by arbitrary allowances based on a very short run and are not based on actual operating conditions over a period of a year. Any one who has worked in a test laboratory realizes what a difference there may be between a test run and an actual run.

4. *You* are to remove the equipment from cars and place it on foundations which *you* are to provide, and *make* the necessary piping and electrical connections. We will furnish a competent erector to superintend the erecting and starting of the engines, *at the price* per day named on the last page of the attached specifications, and you are to pay us for his services within thirty (30) days from receipt of invoice.

5. *You* are to complete all of the above work within sixty (60) days after receipt of the equipment at your plant.

For a concern which has not been manufacturing power to install a complete generating plant within 60 days generally means some interference with regular operation of the existing boiler plant and generally involves overtime for labor and supervision. This contingent expense should be added to the purchase price and would probably amount to at least $600, bringing the total cost of the installation up to $46,000.

6. During the life of this contract it is understood and agreed that we are to charge you monthly an amount equivalent to the current generated by this equipment at the rate of approximately 1.726 cents per kilowatt-hour on an output of 106,933 kilowatt-hours per month, *whether* you use a greater or less amount. *This would amount to a monthly charge of $1,845.36*

When the customer agrees to this paragraph he is practically committing himself to a flat rate for power for a term of years. This means that while power rates may be reduced in this period he will have to continue to pay the upset figure in the contract. On the other hand, if his operations are substantially curtailed over a period of years he will have obligated himself to a large capital investment, the fixed charges of which will amount to a very substantial item if the quantity of energy utilized is greatly reduced.

7. We are also to charge you each month during the life of this contract the value of 167 tons of coal per month now required to generate steam for day-heating purposes, which steam can be obtained from the exhaust of the engines we are proposing to furnish, coal being taken at $4.18 per short ton. This would amount to a monthly charge during the life of this contract of $698.06.

The engine is to be credited with all of the exhaust steam which it produces, but the engine company has not made any test to prove whether during certain hours of every day and during warm months a large part of this exhaust steam might not be wasted, while at other times live steam would have to be added. The engine could supply only 45 per cent of the steam when and as needed.

8. From these monthly bills which we render you for current and heat, we will credit you with the cost of coal required to produce 101,312 kilowatt-hours (this is equivalent to the current for which you are charged in Par. 6 after deducting transformer losses and motor-generator losses that would exist were you to purchase current), the amount of which coal is to be determined by hereinafter mentioned operating run, the price being $4.18 per short ton delivered at your boilers.

Like many generating equipment manufacturers, this one overlooks the fact that from 3 to 5 per cent of the output of the generators will be absorbed in the generating plant itself, but does not fail to add any transformer or motor-generator set losses that occur with purchased power.

9. From these monthly bills which we render you for current and heat we will also credit you the sum of $175 per month for supplies and renewals on the equipment we are proposing to furnish, and for the *increased capacity* that may exist on the boilers at certain times during the year and for extra water consumed by same.

The allowance for supplies and renewals and for the cost of providing increased boiler capacity is very modest, to say the least. An allowance of 2 mills per kilowatt-hour would be very conservative. This would be $212 per month for an output of 106,000 kw.-hr. However, this item would be very materially increased if the boiler pressure had to be raised or if additional feedwater treatment were necessary or if superheaters were required to give the proper quality of steam.

10. From these monthly bills which we render you for current and heat, we will also credit you for the sum of *$143* per month, which it is understood and agreed will be the additional cost of *labor* required to operate this plant over the labor required if you continue to purchase central-station current. It is understood and agreed that if any additional labor is required to operate this equipment, you are to employ same yourselves and that we will render you no credit from the monthly bills for current and heat for any additional labor you may employ over the above-named amount.

It is surprising how many industrial plant owners can be led to believe that two or three generating units requiring exacting conditions of steam supply and continuous operation of the power plant, regardless of factory operating conditions, can be operated with one man or frequently no man at all. It is not probable that a factory owner would install a piece of production machinery costing nearly $50,000 and expect it to be operated and maintained by one man in 24 hours, but power plant operators are sometimes considered to be miracle men who can keep a generating plant in perfect condition by absent treatment. In this particular case allowance has been made for but one engineer in 24 hours. If this engineer wants to "sleep o' nights" the man-

agement will sooner or later have to add an assistant engineer for each of the other two shifts. This would cost an additional $250 per month or a total labor of $393 per month. The engine company must be given credit for its frankness in calling the purchaser's attention to the fact that he may have to employ additional labor, but of course that will not affect the savings —much.

11. Our *cost* of conducting this operating run shall be *added* to the deferred payment and be paid for by the equipment itself.

This neatly worded statement might lead the purchaser to believe that the equipment has the marvelous ability of paying for everything itself. One might suspect these engines of coming complete with "tin boxes" from which the purchaser would be able to take all the money required to install, maintain and operate the equipment forever.

12. In addition to the payment of the net amounts of the bills which we render you monthly for current and exhaust steam, you are also to pay us interest at the rate of ½ per cent per month on the amount of the deferred payment still remaining unpaid at the time of making each monthly payment. These interest payments are to be made monthly at the time of making your monthly payment for service. The first monthly interest payment shall date from thirty (30) days after arrival of the apparatus.

Inasmuch as it is conceivable that the estimated savings under this contract are higher than may actually be realized, it is clear that the amount of deferred payments at any moment may be larger than anticipated. This simply means that the item of interest may become very important before the equipment is finally paid for and the total interest payments certainly must be added to the purchase price of the equipment. Interest of ½ per cent per month on the unpaid balance will amount to at least 9 per cent of the total installed cost ($46,000) over the term of the contract, or $4,140. This brings the customer's equivalent investment to $50,140 (instead of $36,400).

13. The first monthly payment with interest shall be due and payable one calendar month after starting of the engine and generator equipment in your plant; successive payments to be made us promptly at intervals on one calendar month thereafter during the life of this contract.

It quite often happens that an engine installation is not able to carry the entire factory load for the first month or two after installation and some purchased power must be used in this preliminary period, but this does not relieve the customer of the obligation to make regular monthly payments on the engine.

14. If for any reason not under our control the operating run is not conducted within sixty (60) days after receipt of the apparatus it is understood and agreed that you are to begin making monthly payments on the basis of $1,300 per month, with interest as above stipulated, which monthly payments shall continue until you notify us that it is possible to have the operating run conducted, after which operating run the payments will be based on the results as determined by this operating run.

The manufacturer makes sure that whether the engine works satisfactorily or not at the start he will receive monthly payments based on his own estimate of the possible savings.

Operating run

17. As soon as the engines and generators have been placed in operation in your plant, we will conduct an operating run on the *larger* engine to determine the number of pounds of coal required to produce a kilowatt-hour with this equipment.

The operating run is to be based upon the more efficient of the two units as the smaller unit is to be used during periods of light load and for direct-current use. The added cost of producing power during periods of light load may possibly exceed the total savings possible on the more efficient unit running fully loaded.

18. You are to provide the boilers with settings, a heater of type and capacity satisfactory to us, and all necessary auxiliaries and equipment to make a complete and efficient electric power generating and heating plant.

With any generating equipment installation the customer is generally obliged to improve his boiler plant and in many cases to make further investments equal to or exceeding that in the generating equipment itself. The fixed charges on this added investment are almost never included in the engine company's estimates of comparative costs.

19. A load ranging from 300 to 600 kw. shall be provided, we furnishing a water rheostat, if necessary, to obtain this load.

In determining the fuel economy for the test run the equipment manufacturer is careful to provide a load of at least 50 per cent capacity and thereby avoids the penalty that the customer must pay for operating this equipment at light loads for considerable periods of time, such as nights, Sundays and holidays. These tests runs, based on better than average load conditions, may be little less than outright fraud because the customer has been induced to purchase the equipment on an estimate of comparative savings based on this test run, whereas the actual running conditions of the plant are almost certain to be quite different. At the same time the central station is prevented from serving or continuing to serve this customer by the representation of the engine company based on this inclusive test run. Furthermore, the engine companies advertise the phenomenal savings which they claim to have produced on these test runs and thereby lead many central-station customers to believe such savings are possible over a period of time and thereby induce these customers to believe that they are being overcharged by the power company from 50 to 200 per cent. After these engines are once installed it is difficult for the customer to determine accurately just how much he has saved or lost by the change as he seldom keeps his power plant costs in a way to show him at any time the comparative costs of generated and purchased power. The net result is that the customer frequently believes he has made an actual saving, whereas he has incurred a loss.

* * * * * *

22. The steam pressure maintained at the throttle during the operating run shall not be less than 125 lb. gage; the back pressure at cylinder exhaust flange shall not be more than 5 lb. gage.

Boiler pressure must be maintained during the test run, although it is a known fact that in most plants the boiler pressure will at times drop when called upon to meet sudden demands for building or process steam. For similar reasons the back pressure on the engine will sometimes rise. These factors necessarily affect the over-all economy of the engine. Conducting the test run on a holiday avoids these conditions unfavorable to high economy.

23. The boiler during the operating run shall be in such a condition of cleanliness and the coal shall be of such a quality as to show an evaporation of at least 8.5 lb. of steam per pound of coal as fired, and the boiler and setting shall have the same warmth at the beginning of the operating run as it has during the conduct of the operating run.

24. In case your boiler equipment during the operating run does not show an evaporation of at least 8.5 lb. of water per pound of coal as fired, the results of the evaporating run shall be calculated on the basis of 8.5 lb. of water having been evaporated per pound of coal.

The engine company may get the customer to claim a high rate of evaporation for his boilers and then use this high rate as a basis for estimating the small amount of fuel required to operate the engine. If this high evaporation and low cost of fuel cannot be maintained over the life of the engine the purchaser makes up the difference out of his own pocket. Figures on evaporation should be based on long periods, preferably a year.

* * * * * *

29. All conditions pertaining to the operating run shall be made satisfactory to our representative, who shall have the privilege of making such adjustments to the equipment we are proposing to furnish as he deems necessary.

All the conditions of the test run must be made satisfactory to the engine company representative, but no attempt is made to conduct the test under conditions that are likely to obtain in actual operation. The engine is to get all the "breaks."

30. It is further understood and agreed that all payments above stipulated shall be made promptly without the necessity of demand therefor, when due; and that in default of any payment or payments required to be made as aforesaid, the *entire* remaining amount of deferred payments shall, after ten (10) days' notice in writing by the company, become due and payable upon demand made in writing by it, and shall not be subject to any set-off or counter-claim of any kind; and in case of the appointment of a receiver for the purchaser, or a general assignment by the purchaser for the benefit of creditors, or the filing of a petition in bankruptcy by or against the purchaser, such event shall have the effect of a default and thereupon the entire remaining amount of deferred payments shall become forthwith due and payable with the same effect as if the time for payment thereof had fully expired by the terms of this contract; but the engine company shall remain liable to the performance of its

contract after delivery of said equipment only in like manner as if the same had been fully paid for in cash at the time of delivery.

The purchaser may think the engine is to be paid for out of savings, but if an argument arises as to whether or not any savings have been effected and the purchaser defaults in payments, he is likely to find that he has bought an engine outright.

* * * * * *

34. You are to furnish repairs, if necessary, and maintenance for this equipment during the life of this contract.

The engine company protects itself by demanding that the purchaser maintain the engine during the life of the purchase contract, but has allowed practically nothing for this item in the estimate of comparative costs (see paragraph 9).

* * * * * *

THE ENGINE COMPANY.

ADDENDUM

1. If after you have made us thirty-five consecutive monthly payments *in accordance with the terms and conditions* named in the attached contract, the deferred payment of $36,400 (not including interest) has not been fully remitted, then, at the time of making the thirty-fifth consecutive payment, with interest, we will give you a bill of sale and title to the plant for the sum of one dollar and you will not be required to make any further monthly payments under this contract.

2. The attached contract shall not be changed by this addendum in any other way, shape or manner.

THE ENGINE COMPANY.

This customer was cautious and obtained this supplementary agreement that if the payments under the terms of the contract did not equal the purchase price of the equipment itself within 35 months he would be given title to the equipment. This modification did not waive the customer's obligations to pay interest on the unpaid balance nor did it relieve him from the necessity of making additional investment required as a result of the engine installation. In some cases this modifying provision would have saved the customer less than one-third of his actual total capital outlay.

Even when the final payments on the engine have been completed, provision must be made for continued payment of insurance and taxes and for ultimate replacement of the entire installation through obsolescence. Added to all this, future reductions in purchased power rates may completely wipe out even the apparent savings.

Possible Savings With Uniflow Engine Based on Foregoing Proposal

Investment		
Down payment	$1.00	
Deferred payments		$36,400
Installation and boiler changes		9,000
Interference with plant operation		600
Interest on deferred payments		4,140
Total cost of installation		$50,140
Annual Operating Costs With Engine		
Insurance and taxes on investment at 2½ per cent on equipment only		$1,125
Cost of live steam after allowing proper credit for exhaust steam		4,608
Supplies and repairs		2,100
Additional labor		4,800
Coal for power		9,720
Standby service		3,036
Total operating costs		$25,389
Present costs with purchased power (including heating)		28,237
Difference in operating costs — available for amortizing investment		$2,848
Time required to amortize investment		17.5 years

(Rather long to wait to get one's money back, especially when power rates are likely to be reduced several times within such a period of time. The proposal implied that the engine would pay out of savings within three years.)

The joker clause in the foregoing contract is the provision for basing the estimated savings and payments for the engine on a "test run." If the engine meets the conditions of this test run (and few engines cannot be made to meet what are little more than acceptance runs to meet water rate guarantees) the savings are thereupon established. When the customer accepts the results of the test run he has bought an engine. The notes and contract have already been discounted at the bank by the engine company, so it is "in the clear"—with the purchaser holding the bag if the actual savings are less than the amount required to retire the notes and pay the interest. The purchaser of an engine under one of these contracts is likely to find himself one fine day with an obsolete engine on his hands and notes still coming due at the bank. The only party to these contracts who really guarantees anything is the purchaser, who guarantees to pay for the engine.

Let the engine company collect the savings

If the savings were as large as advertised, the engine company should retain ownership in the equipment, contract to sell power to the user over a period of years and pocket the profits. These companies advertise savings to users of as much as 131 per cent. No one believes that the engine companies are making 131 per cent net profit on their own business. If the power salesman can induce his customer to ask the engine company for a simple contract to furnish him power for a term of years at the rate claimed for the engine installation, few engines will be sold in his territory. Purchased power is a complete service and an engine company should be asked to furnish just as complete a service, labor and all. A request to the engine company that it guarantee to do this will show the prospect whether the statements of probable savings are to be taken seriously or not.

▼

Air-Conditioning Show Arouses Interest

By K. C. PORTER*

Commonwealth Edison Company, Chicago, Ill.

One person out of every twenty who visited the show of air-conditioning equipment in the electric shop of the Commonwealth Edison Company last summer became a sales lead. Manufacturers were invited to display their equipment without charge. Our only request of them was the presence of a representative and a record of the number of leads and sales. To stimulate interest in this show, announcements were sent to a selected list of professional and commercial customers, letters were sent to architects, chain store operators were telephoned and newspaper advertising was used before and during the show. Public interest was most gratifying, with attendance averaging above 2,000 per day, and an estimated total of 38,000. Results of the show appear in the accompanying tabulation.

Results of Chicago Air-Conditioning Show

Type Equipment	No. Mfrs. Represented	Leads	Sales
Air filtration	4	224	3
Furnace conditioners	3	349	2
Ice room coolers	9	677	66
Cooling fans	2	167	40
Mechanical conditioners	6	319	2
Humidifiers	2	201	13
	26	1,937	126

*Excerpt from report to Great Lakes Power Club.

Protective Interlocking Schemes Used on Philadelphia System

By CLEMENT S. SCHIFREEN

Electrical Engineering Division
Philadelphia Electric Company

ALTHOUGH major reliance against errors in switching and blocking is placed on the selection and training* of the personnel assigned to the operation of the system, interlocking systems with supervisory and preventive functions have been found to be well justified on the Philadelphia Electric system as insurance against personal errors that might result in loss of life, personal injury, interruption to service or damage to apparatus.

I—*Disconnecting Switches*—Various means of interlocking disconnecting switches with their associated oil circuit breakers have been used, depending on the nature of the equipment, and have proved successful in preventing the accidental opening of disconnecting switches under load and the closing of oil circuit breakers and associated disconnecting switches in the wrong sequence where such error in restoring system tie lines and

**An intensive course of training and tests is conducted under the supervision of the operating and personnel departments.*

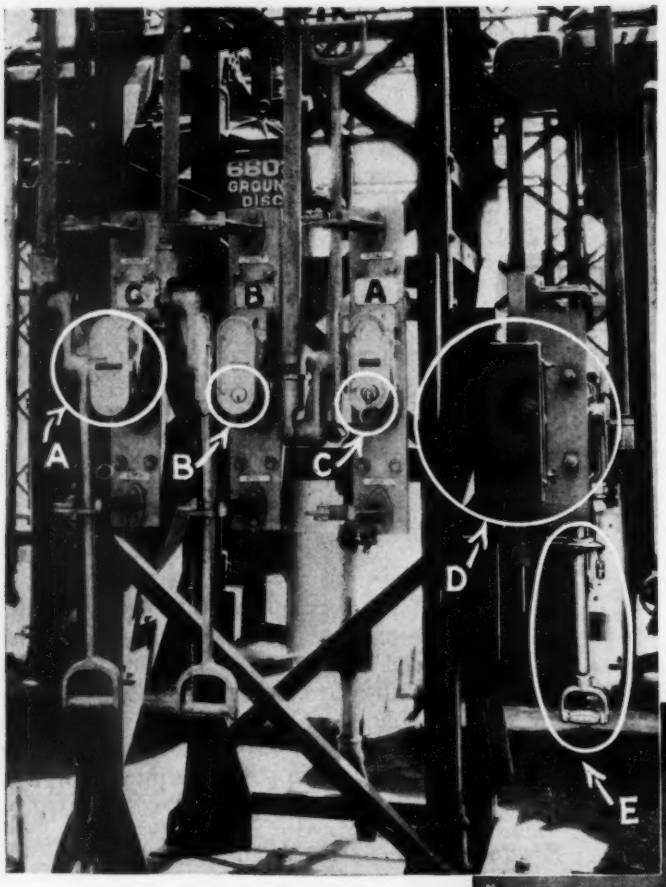


Fig. 1—Key interlocks on individually phase-operated grounding switches on 66-kv. underground lines (left)

A—Protective cover over tumbler lock. B—Grounding switch is locked open when key is "out" of the Cory interlock. C—Key has been inserted to permit closing the grounding switch. D—Weatherproof box containing the key interchange unit, to receive the disconnect switch keys and release the grounding switch keys. E—Isolating disconnect switch locked in the open position by the removal of the key from a similar Cory interlock.

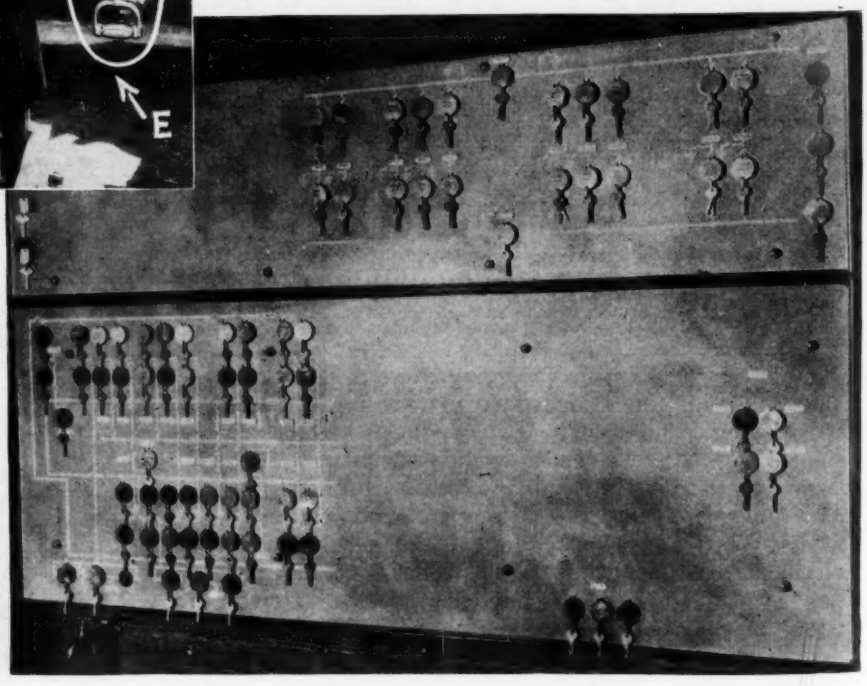
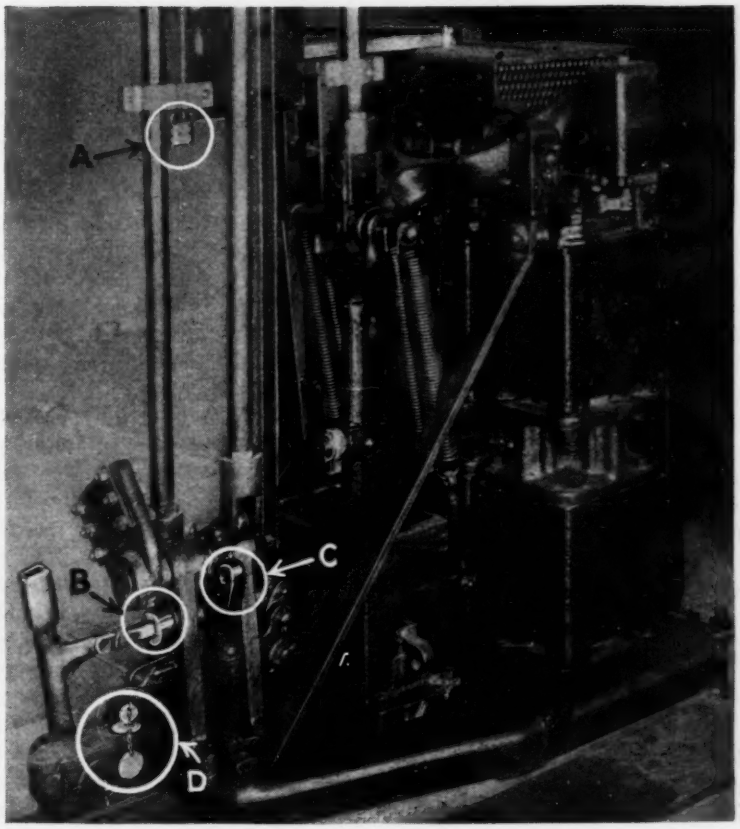


Fig. 2—Panel in operating room for interlock keys (right)

Each key position represents an oil circuit breaker on the 66-kv. bus (upper panel) and on the 13.2-kv. bus (lower panel). One of the keys for each 66-kv. oil circuit breaker is used in the Cory interlocking sequence to operate the associated disconnecting switches. The second key (on the same hook) is used to open the padlocks on the oil circuit breaker mechanism inclosure and hand-operating levers. The keys on the 13.2-kv. hooks are used in the interlocking of the disconnecting switches. The keys for the mechanism inclosures and hand-operating levers of these oil circuit breakers are at the right of the lower panel (three duplicates for the common padlocks on all outgoing 13.2-kv. line oil circuit breakers, and four individual keys for the four main transformer oil circuit breakers in the feeds to the 13.2-kv. bus). Three duplicate grand master keys, kept under seal, can be used to open any Cory lock in the substation in emergency.

Fig. 3—Mechanically interlocked oil circuit breaker and disconnecting switch mechanisms (right)

Also shows Cory interlock on the disconnect switch mechanism used in connection with compartment door locking.
A—Padlock on disconnect switch mechanism to prevent unauthorized operation. B—The plunger can be moved forward to engage in the hole in the disconnect switch mechanism lever only when the disconnect switch is open. Key must be reinserted in the interlock to disengage the locking plunger. C—Mechanical interlocking pin locks the disconnect switch in the "open" or "closed" position when the oil circuit breaker is closed. D—Key must be removed only when the plunger is engaged to lock the disconnect switch open. This key is used in an interchange sequence to open compartment doors over equipment isolated by the associated disconnecting switches.



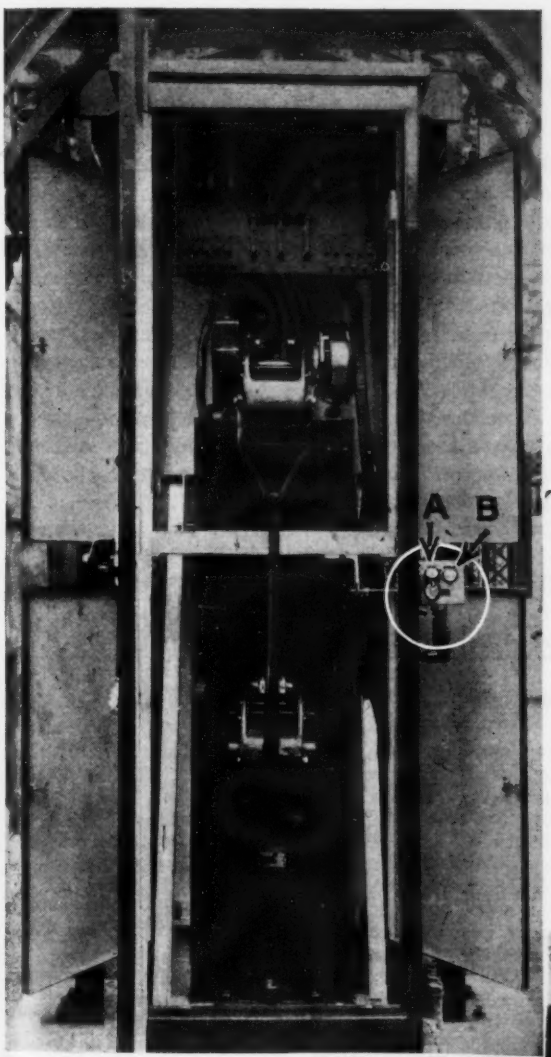
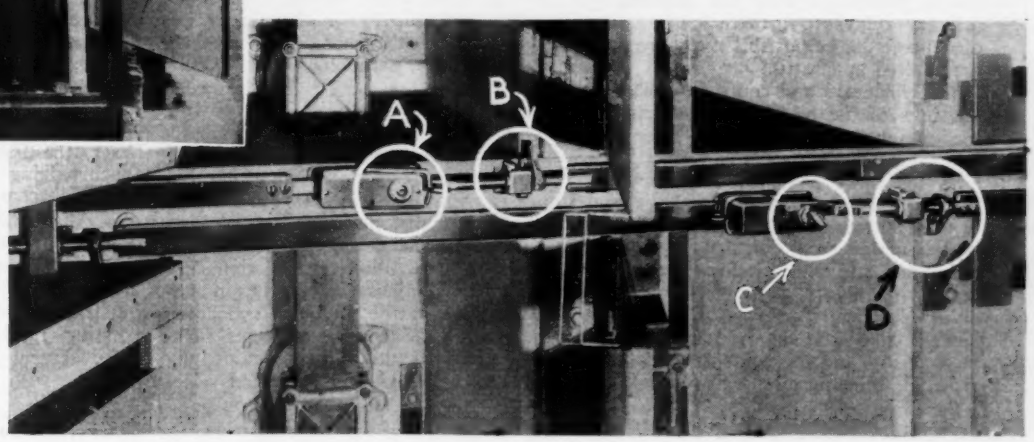


Fig. 4—Oil circuit breaker interlocked by keys (left)

The mechanism inclosures are normally padlocked and are opened only for inspection and maintenance. They are not opened in the Cory interlock sequence for the operation of associated disconnecting switches.
A—This key is released after the other key from the operating room is inserted and turned, provided the oil circuit breaker is open. This key is used to open the associated disconnecting switches, and must be reinserted in order to close the oil circuit breaker from the operating room control panel and to release the operating room supervisory key. B—Key from operating room (individual for each oil circuit breaker) is inserted in this position and is locked in this location by the removal of the other key.

Fig. 5—Key interlocks applied to 13.2-kv. compartment door locking (below)

The number of interlocks are determined either by physical conditions or by the nature of the electrical circuit and its association with the isolating disconnect switches. As many keys are released at the key interchange cabinets as there are compartment door interlocks.
A—Key is normally out of the interlock when the equipment is in service. (For this position of the interlock the doors would be closed and locked by the locking clips.) B—Locking clip in the "closed" position. C—Insertion of Cory key has permitted "throwing" the interlock to unlock the doors by moving aside the locking clips. D—Locking clip.



rotating apparatus to service would result in serious interruption to service or damage to equipment, or both.

1. *Cory Interlocking*—In the outdoor 13.2-kv., 33-kv., 66-kv. and 220-kv. major transmission substations this class of switching error has been eliminated by attaching Cory interlocks and padlocks to the operating mechanisms.

The scheme involves an interchange and release of keys to permit authorized sequential operation of otherwise locked disconnecting switches. Keys which are different for each oil circuit breaker are normally kept in the operating room and serve to prevent unauthorized blocking (Fig. 2). The insertion of one of these keys in the interlock attached to the oil circuit breaker mechanism permits the release of a second key provided the oil circuit breaker is in the open position (Fig. 4). The release of this second key prevents the electrical reclosure of the oil circuit breaker from the remote control panel. This key is then used to open the padlocks or release the interlocks on the associated disconnecting switch mechanisms.

The excellent operating record attained in switching at these very important transmission substations may be attributed to a large extent to the judicious application of Cory interlocking.

2. *Mechanical Interlocking*—The gang-operated 13.2-kv. disconnecting switches installed indoors in the two most recent generating stations have been mechanically interlocked with the mechanisms of the associated oil circuit breakers (Fig. 3). This scheme is feasible where the mechanisms of the disconnecting switches and the associated oil circuit breakers are located adjacent to each other. Supervision of operation and the prevention of unauthorized blocking are obtained by padlocking these disconnecting switches, requiring the use of keys which are normally kept in the control room.

3. *Electrical Interlocking*—The electrically operated 220-kv. air-break switches used at Conowingo station to sectionalize the main 220-kv. bus, or as line ring-bus tie switches, and which do not have oil circuit breakers directly associated with them are electrically interlocked through a special supervisory interlocking panel with other switches and circuit breakers to prevent their improper operation which might result in loss of load, or flashover causing a total bus interruption and damage to apparatus.

This interlocking panel occupies a separate section of the switchboard in the control room and is built in the form of a miniature single line of the 220-kv. switching structure with continuous lamp indication of the position of all the oil circuit breakers, isolating disconnecting switches and the interlocked air-break switches. The interlocking is obtained by means of a single interlocking network which is transferred by manually operated control switches from the control circuit of one air-break switch to that of another to permit remote operation. This design has reduced to a minimum the number of breaks in each control circuit, thus minimizing control troubles, and at the same time maintaining the greatest flexibility of operation. The operation of this interlocking panel has proved very successful not only in the prevention of operating errors but also in facilitating and expediting switching due to its supervisory features.

4. *Guard Lamps*—Operation of the 13.2-kv. indoor hook-stick operated disconnecting switches in the distribution substations and the older generating stations is supervised by means of guard lamps which are energized when the associated oil circuit breakers are open. Despite the objection that the operator can ignore the indication and open the disconnecting switches under load, the scheme functions very effectively. These disconnecting switches are installed behind locked compartment doors so that unauthorized operation is prevented.

II—*Application of Safety Grounds*—1. *Grounding*

Examples of Miscellaneous Control Interlocks

Used Throughout Philadelphia Electric System.

1. Closing circuits of the oil circuit breakers on generators, system tie lines, etc., are interlocked through the synchronizing receptacles.

2. Closing circuits of the oil circuit breakers on major apparatus are interlocked through the hand-reset auxiliary relays associated with the differential primary relays to prevent aggravation of damage due to possible reclosure onto the faulted apparatus.

3. Trip levers and control mechanism housings of the oil circuit breakers for the major transmission tie lines and important apparatus are padlocked. The keys for these padlocks are individual for each oil circuit breaker and are kept in the control room on a panel like the one shown on page 792.

4. Start and run switches of condensers, large motors, converters, etc., are either electrically or mechanically interlocked, depending on the nature of the mechanisms and the control.

5. The tripping circuit of the field air circuit breakers of large rotating synchronous equipment are interlocked with the main oil circuit breakers to prevent opening from the remote control switchboard while the apparatus is in service.

Oil circuit breakers in the feeds at customer substations having dual service are mechanically or electrically interlocked or both where such services should not be paralleled on the customer's bus.

7. A special high-speed interlock has been designed to render inoperative high-speed parallel line relays at the same instant that one of the two parallel lines is tripped by a high-speed relay.

8. A specially designed interlocking preferential scheme has been installed at one of the 220-kv. transmission substations to obtain secondary bus potential for use in the standard synchronizing scheme. Secondary voltages, serving as bus potentials, are obtained by the automatic and predetermined selection of the potential transformer secondaries of lines operating on the respective buses. Thus, if the first preferred line is not in operation on the bus for which it normally supplies bus potential, the potential transformers of the second preferred line, if operating on that bus, are automatically and immediately selected to serve as bus potential for that bus section. In this manner a secondary voltage is always available if the bus is energized. Since this scheme permitted the elimination of potential transformers from the 220-kv. buses, the installation of the standard synchronizing interlock was made possible at a reasonable cost.

9. An interlocking circuit has been designed to permit the use of only one control switch to control two oil circuit breakers, one on each side of starting transformers used in starting large rotating machinery and, at the same time, assure proper sequence of operation.

Switches—Grounding switches are provided at all points where safety grounding is desired in the 220-kv. transmission substations, on the buses and lines in the major 66-kv. and 33-kv. transmission substations, on the buses in the major 13.2-kv. transmission substations and generating stations and in certain exceptional cases on the 13.2-kv. system. The Cory interlocking system is used to prevent the improper operation of these grounding switches in all of the above-mentioned installations with the exception of a few 13.2-kv. bus grounding switches in the older generating stations. In the latter installations the bus is first grounded through a fused resistor circuit and subsequently by means of the solid ground if the bus is found to be de-energized.

In the Cory interlocking applications the key sequences between the Cory interlocks on the mechanisms of the disconnecting switches and those on the grounding switches (Fig. 1) are so arranged as to require locking all the disconnecting switches in the open position which are required to isolate from all sources of energy the particular group of conductors to be grounded by the grounding switches involved. Conversely, these disconnecting switches cannot be reclosed to restore the equipment to service until the necessary keys are obtained by opening the associated grounding switches.

2. *Portable Ground Clamps*—Generally, grounding on the 33-kv. and 66-kv. oil circuit breaker terminals and on the 13.2-kv. and lower voltage conductors is accomplished by means of portable ground clamps. Interlocking to prevent grounding live circuits is provided only at those locations where the compartment doors are locked under the Cory key system, as will be seen under section III below. At other locations safe operation is contingent upon both personal check and the use of high-voltage detector tubes.

III—*Compartment Doors*—At the two most recently constructed generating stations the compartment doors over the indoor 13.2-kv. equipment and conductors are locked under the Cory system (Fig. 5). In the remaining generating and substations the padlocking of the 13.2-kv. compartment doors is merely selectively interlocked, so that individual keys are provided for each group of compartment doors for each generator, frequency converter, system tie transformer feed or other major piece of apparatus, while the compartment doors over all the outgoing lines are padlocked under a common key.

Where the Cory interlocking system is provided the key sequences are arranged between the mechanisms on the disconnecting switches and the compartment door interlocks so that only those compartments can be entered which have been properly isolated from all sources of energy (Figs. 3 and 5). This system of interlocking incidentally assures the safety of applying the portable safety ground clamps, and due to the layout whereby the compartment doors cannot be closed until the portable ground clamps are removed the possibility of neglecting to remove the grounding cables before restoring the apparatus to service is avoided.

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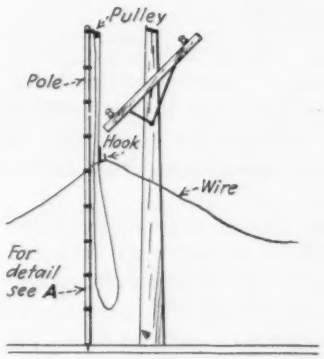
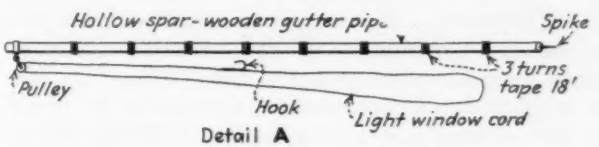
To Speed Up Wire Erection

By GUY F. HARDEN



To avoid carrying overhead wire up poles by hand in line erection an effective method was developed which utilizes wooden gutter pipe as a hollow spar worked from the ground. A length of this material provided with a spike at the bottom and a pulley



Detail A

near the top through which light window cord is run enables the wire to be quickly raised to the crossarm by a hook attached to the cord. The spar is taped around every 18 in. to increase its strength.

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United States Second in Electrical Exports

Electrical exports from nine leading countries decreased 24 per cent in 1931 compared with 1930, according to a table published in *World Power*. The fall in general activity in the electrical manufacturing industries of the world, it is pointed out, beginning in about the second quarter of the year 1930 was not immediately followed by a slump in trade.

This was partly due to efforts by manufacturers to counteract the decrease in their home markets by laying greater stress on the export business. The decline in money value of exports during 1931 is ascribed not to a fall in prices but to a general lack of purchasing power, regardless of price, in the main electrical markets of the world.

Total Exports* of Electrical Goods From Nine Countries

	1928		1929		1930		1931	
	Values (£000's)	Percentage of Total	Values (£000's)	Percentage of Total	Values (£000's)	Percentage of Total	Values† (£000's)	Percentage of Total
Great Britain	18,334	22.2	19,535	19.3	18,264	18.4	11,796	15.5
U. S. A.	20,630	25.0	29,100	28.8	26,250	26.4	19,200	25.2
Germany	23,820	29.0	26,620	26.4	30,600	30.7	26,800	35.1
Holland	5,180	6.2	10,350	10.2	8,553	8.6	5,920	7.8
France	3,390	4.1	3,760	3.7	3,730	3.7	3,340	4.4
Sweden	3,990	4.8	3,500	3.5	3,850	3.9	2,690	3.5
Switzerland	3,063	3.7	3,390	3.4	3,530	3.5	2,940	3.9
Austria	2,042	2.5	2,510	2.5	2,470	2.5	1,580	2.1
Belgium	2,050	2.5	2,200	2.2	2,335	2.3	1,880	2.5
Total	82,499	100.0	100,965	100.0	99,582	100.0	76,146	100.0

*Values are given in English pounds. †Conversion at par.

Alabama Legislates to Regulate Holding Company

By HUGH WHITE*

President Alabama Public Service Commission
Montgomery, Ala.

SOME of us have been on record in the records of this national association for several years as being very strongly of the opinion that utility holding companies, under the law, not only may be regulated, but in the public interest should be regulated, at least in the matter of their security issues.

Unfortunately for the people of Alabama, we have had a bit of the same sort of betrayal as well-nigh wrecked some of the operating utilities in the Insull system, and did wreck the personal fortunes of tens of thousands of Insull stockholders. One of the immediate results of the outrages in the instance cited was that the operating utility had to pass the payment of dividends upon its preferred stock. The raiding of the operating utility so weakened its credit position that if any holder of its preferred stock today desired to sell such stock he would find it almost worthless in the market. The decline in prices of labor and materials meantime has been such that the fair value of the utility's properties has substantially decreased, and this, coupled with its greatly lessened ability to earn during the present depression, renders the utility wholly unable to raise additional capital at this time, either through the sale of bonds or preferred stock, for the reason that no commission could justify itself in authorizing such issues, and the issues could not be sold even if authorized.

After having had its credit so severely weakened, the utility is in no position to buy working supplies needed in current operations at such advantageous prices as would be possible if its credit were good. Every dollar of additional cost of such supplies used in ordinary maintenance must necessarily be reflected in the rates to be paid by the consumers.

Unearned dividends prohibited by decree

Long before the damage to its credit will have been repaired by the holding company, the operating utility will have need to make capital extensions to serve new customers and to acquire new business. If it can obtain the capital wherewith to make such extensions, it will necessarily be at a higher cost, and it is difficult to see how the additional cost of such capital, because of its injured credit position, will not to some extent be reflected in its future rates.

When the Alabama commission found that raiding and looting of an Alabama operating utility had been perpetrated by the holding companies, realizing that other holding companies controlling operating utilities in Alabama might be tempted in such direction, the commission issued its general orders U-5 and U-6 to all the public utilities in the state. Under general order U-5 the commission prohibited all such utilities paying any further dividends upon their common stock unless and until earned and further directed that such dividends should not be paid until the utility had first made reasonable proof to the commission that it had provided for reasonable and proper reserves.

General order U-6 directed that the utilities should not pay management or service fees to any other affiliated company where there is an absence of arm's length bargaining between the parties, until after reasonable proof had been made before the commission that services *had been* rendered and that the amount claimed therefor was not in excess of the reasonable value of the services.

Proper service fees unrelated to gross revenue

I shall not devote much discussion to the so-called service or management fees. As a general rule, the holding company or service company does render a service of value to its operating utilities. In some instances it may be that the service fees collected are reasonable for the services rendered, but my personal view is that the amounts of these assessments are too often made without that honest, responsible regard owed to the rate-payers which we have a right to expect from those who have the management and control of the operating utility, and the power to select the agencies by which its operations shall be carried on. In my humble judgment, the state commissions may do well to inquire carefully and vigorously into the question of all these service contracts both as to the measure of service rendered and reasonableness of the charges made therefor. Certainly state commissions should not accept any arbitrary percentage of gross receipts of the operating utility as a reasonable charge for supervision and assistance from the holding company or service company, because no one has ever yet shown that there is any particular percentage formula which furnishes a just measure of the value of such services.

New law reaches out to holding companies

In Alabama we have just been successful in getting a statute enacted (November 9, 1932) which deals with operating utilities, their holding companies and affiliated interests. Affiliated interests include every corporation or person with which the utility has a management or service contract. Under this statute holding company includes every person or corporation which owns or controls as much as 10 per cent of the outstanding common stock of any utility engaged in business in Alabama. The

**Excerpts from address at convention of National Association of Railroad and Utilities Commissioners, Hot Springs, Ark., November 15, 1932.*

parts of this new statute which are pertinent to this discussion as affording a partial answer, at least, to some of the problems which have been presented by the utility holding companies are as follows:

The statute declares the relationship of the officers and directors of a utility corporation as being fiduciary to the corporation and makes it mandatory that such officers and directors shall discharge the duties of their respective offices or positions in good faith and with that diligence, care and skill which ordinarily prudent men would exercise under similar circumstances.

It is prescribed that the directors of utility corporations engaged in any intrastate business in Alabama shall not, in any manner, delegate or temporarily or permanently relinquish or surrender their duty or obligation.

A reasonable enforcement of the two above provisions should go a long way toward lessening, if not entirely preventing, some of the abuses from which some of our operating utilities have heretofore suffered. While it may be true that these statutory provisions, to a substantial extent, only declare that which is already true at common law, yet the statute serves clearly to define the nature and prescribe the bounds of that trust and obligation owed by such officers and directors to the utility, its customers and those investors who have contributed so substantially toward the capital of the enterprise in the purchase of its preferred stock.

Agreements must be filed

Within 30 days after the act becomes law every utility in Alabama must file with the commission a true and correct statement, verified, of every existing agreement between it and any holding company or affiliated interest, substantially affecting the financial status or credit of the utility, or the management or control of the utility by such holding company or affiliated interest. If any such agreement is thereafter modified an accurate copy of the modified agreement must be filed with the commission within 30 days. The commission is given express authority to investigate every such agreement, and if, after due notice and hearing, it finds that such agreement is unjust and unreasonable the commission shall make and enter such order as is just and reasonable relating thereto.

Section 6 of this act is short and has such important relation to the subject we are discussing that I quote it as it is written:

Section 6—No utility engaged in intrastate business in this state shall pay any dividend upon its common stock until:

1. The utility's earnings and earned surplus are sufficient to declare and pay same after provision is made for reasonable and proper reserves.

2. The dividend then proposed to be paid upon such common stock can reasonably be declared and paid without impairment of the ability of the utility to perform its duty to render reasonable and adequate service at reasonable rates.

If any common stock dividends are proposed to be declared and paid other than as above provided, the utility shall give the commission at least 30 days' notice in writing of its intention to so declare and pay such dividends.

In considering the provisions of Section 6 of the act, it must be borne in mind that under Section 10 of the same act the commission is clothed with full power and authority to make investigations for the purpose of enforcing any of the provisions of the statute and to issue orders and decrees to give effect to such provisions of law. The commission is further empowered, when it deems it advisable or necessary, independently or in conjunction with other parties in interest, to apply to the courts for appropriate relief or action in connection with any matter relating to the enforcement of such statute.

Under other provisions of this statute, if it is found at any time that the capital of any utility has become impaired, the commission is empowered, after due notice and hearing, to issue an order directing the utility to cease paying dividends on its common stock until reasonable proof has been made to the commission that such impairment has been made good and that the status of the utility has become such that common-stock dividends may reasonably and properly be paid.

Another provision of the statute is that no utility shall permit any employee to sell or solicit the purchase of any security of any other person or corporation during such hours as the employee is engaged to perform any duty of the utility; that no utility in the state shall require or compel any of its employees to purchase any of its own securities or those of any other corporation.

It will be understood, of course, that this provision will not prevent the employee of any utility purchasing any securities, so long as it is a voluntary act upon his part. We believe this statute will prevent Alabama utilities converting their employees into a sales force for the purpose of selling holding company securities.

Other provisions of this new legislation prescribe that hereafter the utilities may not, without the commission's approval, issue short-term notes when the notes to be issued, together with all other outstanding notes of a maturity of two years or less, exceed 5 per cent of the tangible fixed capital of the utility, as defined in the commission's accounting classification.

Courts hear appeals only on commission record

This Alabama statute, in order to expedite determination of appeals from orders of the commission, provides that the court to which the appeal lies shall hear the case upon the record as certified by the commission and that the appellate court, instead of setting aside the order, may remand the case to the commission for further proceedings in conformity with directions of the court. Heretofore, in Alabama, appeals from orders of the commission have been triable *de novo* in the first appellate court. Experience has shown that *de novo* trials cause considerable delay in getting the case submitted to the trial court. This sort of delay ought, in my opinion, to be avoided wherever it is possible in our judicial procedure. Unnecessary delay, in my humble judgment, constitutes one of the weakest features of our entire judicial system.

Another great value in making the appeal triable upon the record before the commission is that this will compel the parties, and the commission itself, to be thorough and sufficiently comprehensive in the development of the facts in every case of any consequence tried by the commission. Otherwise, the party which does not exercise such diligence will stand in danger of losing upon the appeal.

Federal regulation of interstate securities unavoidable

May I say, that I am in very hearty accord with the views expressed by Commissioner Lilienthal in his recent address before the American Bar Association to the extent that he goes. Particularly do I share with him the view that the several states can go very far in the effective supervision and regulation necessary to prevent recurrence of many of the evils we are discussing which are now matters of common knowledge.

Frankly, however, I have not been able to see how Alabama will be able to protect its operating utilities, their customers and the people of Alabama who have invested large sums in preferred stocks of Alabama utilities against reckless issuance of securities by holding companies organized under the laws of other states and having their habitat in Chicago, New York or in some other city in a distant state. While the holding company in some instances may have its habitat in the same state with some of the utilities controlled by it, it is generally the rule that such companies of any size and consequence own the control of operating utilities in a number of states. As much as I agree with my fellow commissioners in their concern about the extension of the powers

of the federal government into the affairs of the states, I have never yet been able to see how the arm of the state can extend into another state so as to exercise reasonable control over the issuance of securities by a foreign holding company.

I think the developments of the past two years with respect to holding company securities, disregarding the dishonest practices and transactions involved in some instances, have been such as to make it clear that the unrestrained and unregulated privilege of issuing securities by these companies not only affords what has proved to be an uncontrollable temptation to sell the public something without reasonable basis of value, but also makes possible and probable that these holding companies in the future, if unrestrained and unregulated, will repeat past performances and lure the public into purchase of their highly speculative securities in such a way as again to perpetrate injuries upon the public investors and again bring damage and injury upon their operating utilities and all who are interested therein.

I am frank to say that, in my humble judgment, these holding companies, with power to manage the operating utilities, stand in such close relation to the latter as to make utility holding companies occupy a substantially different position from those holding companies which merely own equities, without at the same time having or exercising actual management.

I will not yield to any of my brethren in their desire to prevent unnecessary extension of federal authority into state affairs, where under our basic law the state can regulate and prevent wrongdoing, but I have been unable to see how effective supervision and regulation of the issuance of utility holding company securities can be brought about except by federal authority. Subscribing wholeheartedly as I do to the Jeffersonian principle that as far as possible the government should withhold interference in business, I believe that Jefferson, himself, in our day, would take the position that, when men engaged in business affected with large public interest disclose that, for one reason or another, they will not conduct such business in a proper way, then they cannot complain if the government intervenes in behalf of its people no matter whether that government be the state or the nation.

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READERS' FORUM

The Inventor Offered Evidence and That Made It News

To the Editor of the ELECTRICAL WORLD:

I have just read the note on "New Gaseous Light Source Is Energized by Induction" on page 553 of the October 22 number of the ELECTRICAL WORLD. It is stated in this article that one lamp gives about 20 cp. for each watt of energy used. This would be about 250 lumens per watt, which is a very high efficiency, but one that is theoretically possible. In the next paragraph is a statement that is not at all in keeping with what can be accomplished. The statement is made that a new lamp which they can develop will have an efficiency about 100 times that of the ordinary incandescent lamp. Now an ordinary incandescent lamp operates at an efficiency from 10 to 20 lumens per watt. Thus this new lamp would have an efficiency of 1,000 to 2,000 lumens per watt. The maximum possible efficiency that can be obtained is 620 lumens per watt. One wonders why a reputable magazine like the ELECTRICAL WORLD continues to carry statements like this.

In the second paragraph in this note the statement is made that in operation the lamp is so lacking in generation of heat that it may be held close to the hand without any sensation of warmth. One is inclined to wonder how energy can be radiated at the rate of 10,000 watts without any sensation of heat. Is this possible?

W. E. FORSYTHE.

Lamp Development Laboratory,
General Electric Company, Cleveland.

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BOOK REVIEWS

Elektrische Maschinen, III, Die Transformatoren

(Transformers, Vol. 3 of "Electrical Machines")

By Rudolf Richter. Julius Springer, Berlin. 321 pages, 230 illustrations. Price, 19.50 reichsmarks.

This book will be of interest to designers, manufacturers and, in somewhat less degree, to users of transformers. The author discusses the theory of design and performance, mathematically considered, features of construction and methods used in the building of small and of large transformers, insulation, cooling methods, specifications and tests, and economic considerations.

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Analysis of Electrical Equipment in Copper and Iron Mines of Michigan

By Simeon I. Tourshou. Michigan College of Mining and Technology, Houghton, Mich. Nineteen text pages, nine energy use graphs, two equipment tables, eight connection diagrams. Free on application to Publication Committee.

This is the report of a field survey. It presents detailed descriptions of the four main types of electrical equipment used in Michigan copper and iron mining—hoisting, hauling, air compression and water pumping—with information on performances. The author attempts to find and analyze the reasons for controversies in regard to practices and economies. In this connection he considers the advantages of steam as against electrical equipment and also the comparative virtues of three types of hoists.

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Die Hochspannungsfreileitung

(High-Voltage Transmission)

By Karl Stockinger. Verlag von Julius Springer, Berlin W9, Linkstrasse 23-24. 131 pages, illustrated.

The book deals with the design of high-voltage overhead lines. It considers materials used as conductors, their maximum permissible load, with special consideration of the mechanical stresses due to wind and ice; type and dimensions of the conductor cables; stresses in the supporting poles and towers of various designs. It is profusely illustrated by calculation examples. It may be useful for transmission engineers.

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Men of the Industry

J. P. Kuhn Made President Utilities Commissioners

J. Paul Kuhn, who was elected president of the National Association of Railroad and Utilities Commissioners at the recent convention in Hot Springs, Ark. (ELECTRICAL WORLD, November 26, page 708), has been actively interested in the affairs of that body for approxi-

mately ten years, and at the present time is serving as a member of the Illinois Commerce Commission.

Mr. Kuhn, though a native of Pennsylvania, received his education in the public schools at Batavia, Ill.; Wheaton College, and received the degree of bachelor of law from Northwestern University in 1910, when he commenced to practice law at Batavia. After serving as assistant state's attorney of Kane County from 1912 to 1916 and as city attorney of Batavia from 1913 to 1921, he was appointed by Governor Len Small as assistant commerce commissioner and five years later was made a member of the Illinois Commerce Commission. In 1929 he was appointed by Gov. Louis L. Emmerson as a member of the Illinois commission, in which capacity he still serves. In the course of his legal career Mr. Kuhn organized the law firm of Kuhn & Benson.

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DR. IRVING LANGMUIR, associate director of the General Electric research laboratory, sailed from New York on the *Bremen* November 30 for Sweden, where he will receive the Nobel award in chemistry. Following the presentation of the award, Dr. Langmuir will visit several of the famous European laboratories and will meet a number of the scientists there. His itinerary will include Germany, Austria and Switzerland. He is planning to return to Schenectady in the middle of February.

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COL. OSCAR H. FOGG, vice-president of the Consolidated Gas Company of New York, has been elected a vice-president of the New York Edison Company, its principal electric subsidiary. Colonel Fogg entered business many years ago as an employee of the United Gas Improvement Company of Philadelphia and became identified with the Consolidated Gas organization in 1904. He is a director of nine companies in the Consolidated Gas group.

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L. L. Elden Retires

Leonard L. Elden, technical adviser to the operating vice-president of the Edison Electric Illuminating Company of Boston and one of the most prominent electrical engineers in the power industry, has retired after 47 years of service with that utility. Mr. Elden's career has been closely identified with the growth of central-station service in the New England metropolis from its earliest days, and he has been intimately concerned with electrical engineering development and system planning problems as met by the major Edison companies of the country. For many years he was superintendent of the Boston company's electrical engineering department. More recently he has devoted much time to problems of standardization; interconnection; regional supply, transmission and distribution; appliance motor performance in relation to system regulation; economics of off-peak

water heating; and international electrical affairs. He is a member of the World Power Conference Committee and International Electrotechnical Commission, and has long been prominent in the National Electric Light Association, American Institute of Electrical Engineers, American Standards Association, Association of Edison Illuminating Companies (past president 1918) and National Fire Protection Association. In 1929 Tufts College conferred upon him the honorary degree of doctor of science.

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FRANK E. SMITH has retired as president of Servel, Inc., and subsidiary companies, effective December 1. He will continue as director in all companies, in addition to acting as a special consultant to the management.

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OBITUARY

C. Studebaker, Jr.

Clement Studebaker, Jr., prominently identified with the public utility industry for a number of years, died suddenly, December 3, at his home in Chicago as a result of angina pectoris. Mr. Studebaker was president of the North American Light & Power Company, the Illinois Power & Light Corporation, the Illinois Traction Company, Illinois Traction, Inc., and chairman of the board of the Illinois Terminal Company. Mr. Studebaker was born in South Bend, Ind., 61 years ago. He entered the automobile business founded by his grandfather and carried on by his father, with offices in South Bend, and held an executive position, when he resigned in 1914 to enter the public utility field.

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WORTH BATES, vice-president and general manager of the Missouri Gas & Electric Company, Lexington, committed suicide November 23. He is said to have been despondent because of recent financial losses. Mr. Bates had been associated with the Missouri utility for about 25 years.

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W. J. DANIEL, district manager of the Mississippi Power & Light Company, at Sardis, died November 25, at a camp several miles west of Batesville. Mr. Daniel was 40 years of age and a native of Hernando. He resided in Sardis ten years and for six years had been district manager of the electric utility.

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JOHN H. BURNS, vice-president and general manager of McCarthy Brothers & Ford, Buffalo, died November 23 at his home in that city in his fifty-seventh year. A native of Quebec, Mr. Burns moved to this country at an early age and entered the supply department of McCarthy Brothers & Ford in 1905 after connections with various electrical contracting organizations. He was named vice-president and general manager in 1926.

New Equipment Available

Electrostatic Voltmeters for D.C. and A.C. Voltages

Complete line of electrostatic voltmeters, designed to provide a ready means for measurement of high d.c. and a.c. voltages, particularly in circuits of high resistance where any appreciable current taken by a voltmeter introduces considerable error, has been announced by Ferranti, Inc., New York. These instruments, which are entirely free from wave form, frequency and temperature errors, are available in the single-range projecting, flush or portable types.

The meter can be supplied in nine different ranges, having full scales from 450 volts to 3,500 volts, the capacity ranging from 30 mmfd. with full scale deflection of the 450-volt meter to 5 mmfd. for the 3,500-volt instrument.

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A FEELER GAGE which has been designed to increase the efficiency of Martin-Decker tension indicators has been announced by the Martin-Decker Corporation, Long Beach, Cal. With the addition of this gage, which is incorporated in the indicator itself at a point underneath the clamping device, it is possible to determine exactly when the instrument is in correct position on the cable for an accurate reading, it is claimed.

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A SUBSTITUTE FOR fabric-insulated magnet wire which the manufacturer claims can be successfully used wherever fabric-insulated wire has been applied heretofore, up to and including No. 10 B & S gage, is announced by the Inca Manufacturing Division of the Phelps-Dodge Copper Products Corporation, Fort Wayne, Ind. This new enameled insulation has been developed for the smaller sizes of magnet wire.

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AN ALUMINUM-ALLOY DIE-CAST CASE for the protection of single-phase watthour meters of modern construction has been announced by the General Electric Company. The case is strong, durable and corrosion-proof and protects the meter against most adverse weather conditions. In addition, access to the meter is impossible without positive evidence, either by breaking the seal or by damaging the case itself.

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FOR HANDLING HIGH-VOLTAGE or secondary neon transformer current a motor-driven flasher known as the "Reco Neonimater" has been announced by the Reynolds Electric Company, Chicago, Ill. The principle of the device is based on switching or transferring the high-voltage or secondary transformer current from one terminal to another, precluding any possibility of open-circuiting of the secondary current in the event of failure of one or more tubes.

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PORTABLE, AIR-OPERATED SUMP PUMP intended for use by mines, refineries, general contractors, public utility companies and other fields of service has been announced by the Ingersoll-Rand Company, New York. It consists of an open-impeller type centrifugal pump driven by a multi-vane type air motor and both inclosed in a one-piece housing. The unit weighs 50 lb. and is designated as a sump pump, size 25.

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All-Steel Cable-Reel Hand-Lift Truck

Of all-steel construction, arc welded throughout and designed to withstand the strain of being towed by a tractor over relatively rough floors and roadways when loaded with reels as heavy as 8,000 lb., a new type of cable-reel

hand-lift truck is announced by the Yale & Towne Manufacturing Company, Philadelphia, Pa. Lifting the reel is accomplished by means of a standard Yale multiple lift head which has all working parts running in oil and is sealed to exclude dirt and water.

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MODERNIZING ITS LINE of P. & H. Hansen arc welders, the Harnischfeger Corporation, Milwaukee, Wis., claims that its new magnetic bridge and short-circuit winding will greatly extend the welding range and further improve arc recovery and arc stability. The new dead-front control cabinet adds to the general appearance of the unit and simplifies the design. Voltmeter, ammeter, etc., are contained in the single, compact cabinet.

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SURFACE WIRING in yet another form, marketed as "Xtensionduct," which is a metal duct for extending existing outlets neatly, is announced by the National Electric Products Corporation, Pittsburgh, Pa. It is designed for extension of circuits only and accommodates two No. 14 wires which are laid in the duct and the cover snapped on.

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Coated Electrode for Manganese Welding

New coated electrode for manganese weld, designated as type W-85, has been announced by the General Electric Company. This wire finds its principal application in the building up of worn manganese steel castings to original dimensions and in the repair of such fractured parts. It also can be readily applied to obtain a manganese steel surface on parts of ordinary steel and iron, thereby giving the parts a tough, work-hardening, wearing surface at a low cost.

Some of the outstanding features are: Reliable welds can be made by relatively unskilled operators; when the rod is melted in the atmosphere and applied to ferrous metal articles it exhibits the essential characteristics of standard heat-treated manganese steel; that is, toughness, ductility and surface hardening under cold working; the nickel content overcomes any tendency of the metallic manganese content of the rod to oxidize and prevents brittleness under slow cooling.

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ACROSS-THE-LINE TYPE, automatic d.c. motor controller which employs adjustable means of timing to allow the field current of the motor to build up to full strength before the circuit to the armature is closed is announced by Cutler-Hammer, Inc., Milwaukee, Wis. The starter was designed especially for use on shaker conveyor chutes in coal mines, but is recommended for use on all equipment employing motors rated 15 hp. and below where starting duty is severe.

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RIGID CORES known as "Tru-Form," which it is claimed hold their shape and do not bulge or buckle, as most paper cores of the square type have always done, are announced by the Inca Manufacturing Division of the Phelps-Dodge Copper Products Corporation, Fort Wayne, Ind. These cores are manufactured under a patented process from a treated and reinforced wood, with corners perfectly mitred by special machinery.